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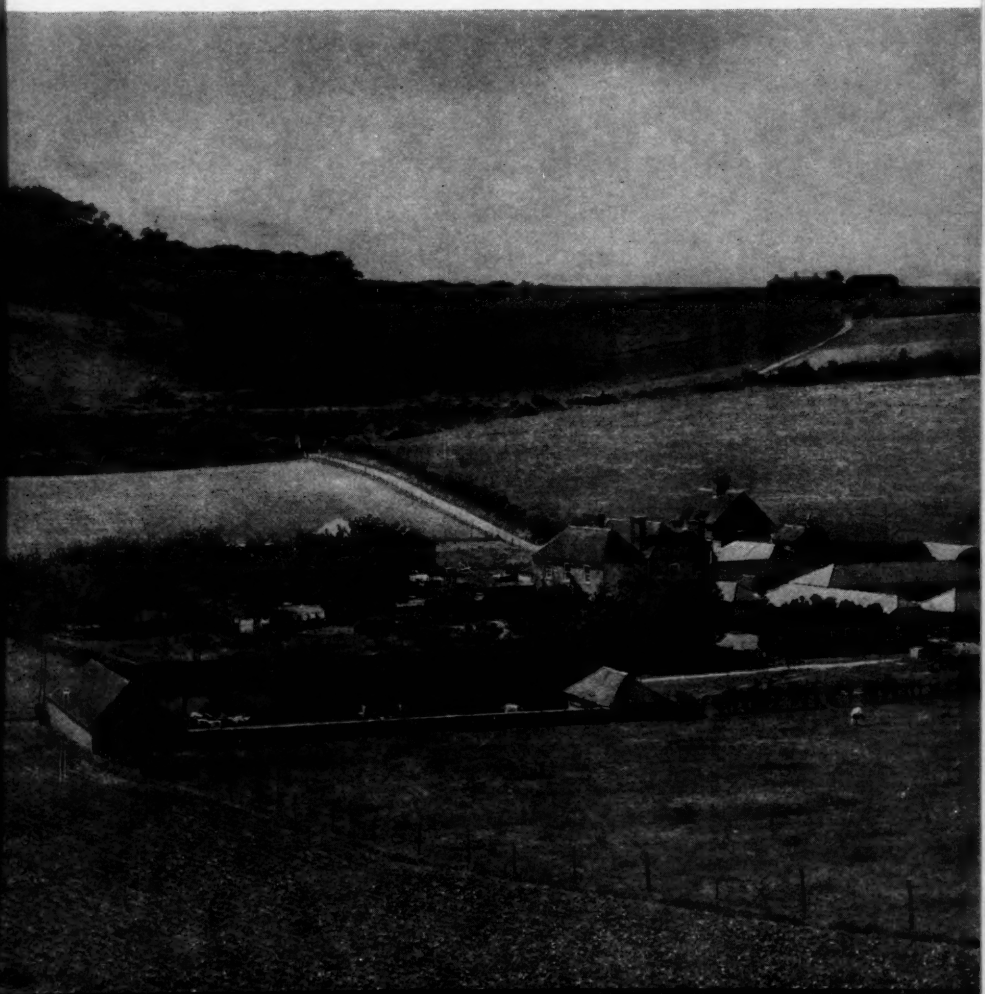

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OFFICIAL APPOINTMENTS

General agriculturists and agricultural specialists of many kinds are frequently required in the effort to match the large demand from the developing countries. The vacancies advertised below are a selection from the many openings which exist now. While they are being filled, other vacancies are arising.

Salaries within the ranges quoted are assessed on qualifications and experience; and the terms of most appointments include free or subsidised accommodation, education grants, family passages, good leave on full pay, etc. A contributory pension scheme is available in certain circumstances.

Most appointments are limited to candidates who should be citizens of, and normally resident in, the United Kingdom.

CAYMAN ISLANDS

Deputy Director Mosquito Research and Control Unit *RC 213/36/01*

Duties: To assist in all aspects of research and control of biting flies and the running of a small but multi-disciplined unit with special responsibility for insecticide testing, and field trials using ground and aerial methods. Experience in latter method essential. Insecticide formulation and the execution of abatement measures.

Qualifications and Terms: Degree in Entomology with practical experience in aerial applications and insecticide testing. The ability to handle labour and undertake administrative duties is also desirable.

Salary: £2,500—£3,000 p.a. plus an inducement allowance subject to revision of £600—£750. Tax free gratuity 20% of basic salary and inducement allowance. No income tax. Age limits 25–40 years. Contract: 2 years.

GHANA

Plant Physiologist *RC 213/70/05*

Entomologist

Duties: To work as members of a team to carry out a programme of research into problems associated with cocoa swollen shoot disease.

Qualifications and Terms: Honours degree in the relevant discipline with considerable post-graduate experience preferably with tree crops in the tropics.

Salary: £1,300—£2,500 p.a. according to qualifications and experience, subject to British Income Tax, plus a variable non-taxable overseas allowance from £705—£1,395 p.a. depending on marital status. Contract: 2 tours of 18 months.

MALAWI

(1) 2 Project Evaluation Officers *RC 213/134/032*

Duties: To undertake the setting up and running of a small unit involved in evaluating the progress, interpreting the results and future planning of the Agricultural Development Schemes.

Qualifications: Degree in Agriculture preferably with post-graduate qualifications in micro Agricultural Economics or Farm Management. Experience with small farmers in tropical agriculture is desirable. A good knowledge of statistical surveying, marketing, evaluation and planning techniques desirable.

OFFICIAL APPOINTMENTS

(2) Agricultural Research Officer

RC 213/134/033

Duties: To act as personal assistant to the Chief Agricultural Research Officer, with particular reference to administration in connection with the professional side of the Research Branch of the Agricultural Division and to be responsible to him for carrying out duties which include the collection and correlation of experimental records and reports, the initial editing and compiling of the Agricultural Research Annual Report, the preparation of special subject matter reports and the handling of routine correspondence.

Qualifications: Degree in Agriculture or allied subject, with practical experience in field experimentation. Specific experience in the writing of reports for publication is also desirable.

Salaries: £958—£1,782, plus an inducement allowance ranging from £527—£818. In addition a supplement of £100 p.a. is payable direct to an officer's bank account outside Malawi and Rhodesia. Tax free gratuity 15%—25%. Contracts 2—3 years.

NIGERIA

Soil Surveyors

RC 213/131/01

Duties: Two soil surveyors are required to be attached to the Land Resources Division of the Directorate of Overseas Surveys of Britain, which is undertaking land resources appraisal in northern and western Nigeria.

Qualifications and Terms: Honours degree in Soil Science, Natural Science, Agriculture or Geography with a post-graduate qualification in Soil Science.

Salary: £1,400—£2,400 p.a. depending on qualifications and experience, subject to British Income Tax, plus a variable non-taxable overseas allowance from £860—£1,705 p.a. depending on marital status. Contract 2 years.

TURKEY

Plant Biochemist

RC 213/181/05

Duties: To lecture on plant biochemistry; to give applied examples in plant biochemistry research and to make plans for a chemistry section.

Qualifications and Terms: A Ph.D. in plant chemistry and a post-graduate qualification of research in plant biochemistry.

Salary: £2,000—£3,000 p.a. subject to British Income Tax plus a variable non-taxable overseas allowance from £420—£935 p.a. depending on marital status. Age limit 50 years. Contract: 1 year minimum.

ZAMBIA

(1) Animal Husbandry Officer

RC 213/132/023

Duties: To plan and promote the development of the animal husbandry industry, to train extension staff in production and management practices and manage pilot ranching schemes.

Qualifications: Degree in Agriculture with experience in animal husbandry work.

(2) Agricultural Officers (Training)

RC 213/132/022

Duties: To direct and organise staff training and short courses for farmers at farm institutes and farm training centres.

Qualifications: Degree in Agriculture with experience of advisory work.

Salaries: Kwacha 1,944—4,464 (£ Sterling 1,134—2,604) p.a. plus an inducement allowance in the range £243—£429 p.a. Supplements from £233—£291 p.a. are also payable direct to an officer's bank account outside Zambia. 25% gratuity. Both supplement and gratuity are tax free. Contract 3 years.

If you wish to apply for any of these appointments, or you are interested generally in an appointment overseas, please write giving your full name, age and brief particulars of your professional qualifications and experience to the:

Appointments Officer
MINISTRY OF OVERSEAS DEVELOPMENT
Room 330a, Eland House, Stag Place,
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The Long Munchtime for cows.

Ted Green is a tenant of the Leconfield Estate, and he's farming 408 acres at North Chapel in West Sussex.

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He has 60 cows, and he's chalking up a gross margin of £109 per head.

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ICI The Fertility People.

Mike Smith B.A. Ag. (Cantab.)
ICI Technical Sales Rep. West Sussex.

Mike is 31, has been with ICI for 8 years. Started off as Development Officer in Cheshire, had a spell with Plant Protection in the Fens, before becoming Technical Sales Rep. in West Sussex.

Mike says: "We're trying to promote sensible use of fertilizer, not just intensive use. Especially when farmers are facing falling yields."

He's married, has two boys and lives at Cold Waltham, Sussex. An eight-handicap golfer, he also finds time to be a keen youth club leader.

Richard Thomson N.D.A. C.D.F.M.
25 year old ICI Development Officer.

Joined ICI in '66, after 2 years on farm and Seale-Hayne Ag. Coll.

Spent a year at Henley Manor concentrating on intensive dairy and beef farming.

Now operates in Hants and Sussex.
Says Richard: "We can provide forward planning for the gradual expansion of farm business even now, when farmers' profits are being squeezed."

Richard is married, lives in East Meon, and divides his spare time between squash and constructing elaborate hi-fi.

Ted Green, Farmer.

At Mitchell Park Farm, West Sussex for 4 years. Previously intensive dairy farming in Berks.

Married, with son and daughter. Son just following in father's footsteps.

Mitchell Park Farm is recorded by ICI. Ted says: "I've been working along with ICI for 22 years, and we've made a lot of progress together."

National Agricultural Advisory Service

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£2913 to £3683

The National Agricultural Advisory Service within the Ministry of Agriculture, Fisheries and Food provides farmers and growers with technical and management advice on agricultural and horticultural matters. The Service is organised on a county and regional basis throughout England and Wales. The successful candidate will take charge of a regional laboratory, the staff of which act in consultative and advisory capacity to the county and district advisers. He will also be responsible for field surveys and investigations. The work entails travel throughout the region.

Candidates (men or women) should normally be aged at least 45 and must have a degree in an appropriate agricultural or natural science, or an equivalent qualification. They should normally have had at least 15 years' relevant experience. This experience should have included responsibility for directing the work of a team of scientists, preferably including one covering microbiology in relation to horticulture and agriculture.

Starting salary may be above the minimum of the above scale; non-contributory pension. Promotion prospects to higher posts within the Advisory Service.

Fuller details may be obtained by writing to the **Civil Service Commission, 23 Savile Row, London W1X 2AA**, or by telephoning 01-734 6010, ext. 229 (01-734 6464 "Ansafone" service after 5.30 p.m.). At all times please quote 7131/PAV. Closing date 5th June, 1969. Candidates who have recently applied should not do so again.

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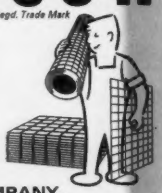

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Agriculture

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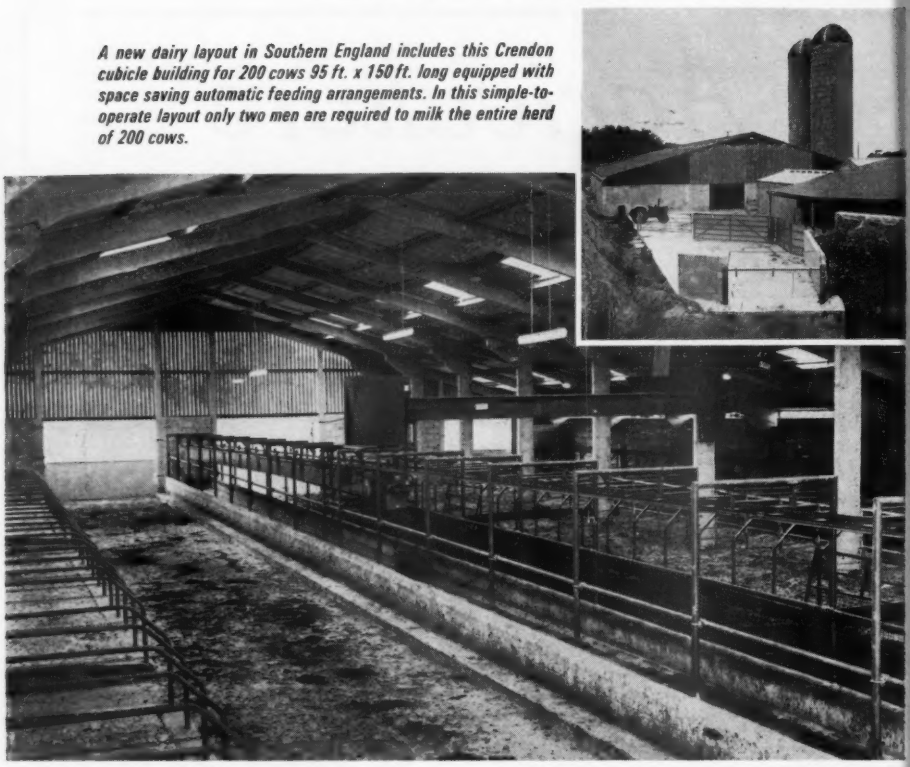

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HOW MANY TREES PER ACRE?

The Intensive Apple Orchard

C. D. Walker

SPINDLE BUSH or Leggerspil, Palmette or just plain Dwarf Bush; whenever apple growers meet to discuss their common problems, the subject of the intensive apple orchard is sure to crop up.

If you cross the North Sea and visit the new fruit farms in Holland you are greeted by a forest of 8 ft stakes. Drive around St. Trond in Belgium and you will see apples on 8 ft wire fences. Go south through Soisson in France to Northern Italy and the new apple orchards show a similar pattern, with the fences becoming taller as the light intensity increases and the effect of shade on fruit quality is less important. All these systems of apple growing have one thing in common, a very high tree density.

The Common Market apple growers have been subject to severe internal economic pressure for some years. There is over-production and everywhere competition is razor-sharp. As a result, the fruit growers have turned to the intensive orchard in one of its many forms, hoping thereby to cut costs and at the same time reduce the unproductive time-lag between planting the

orchard and harvesting its first remunerative crop. To do this they have used the dwarfing rootstock Malling IX, planted at very high tree densities.

In this country similar economic forces are at work and the British apple grower faces just the same problems. He must cut the costs of production and devise better early maturing apple orchards.

This is no new problem, of course. The gardeners of the eighteenth century knew all about it when they grew small trees on 'Paradise' stock. Between the wars cordons and dwarf pyramids were tried. Since the last war we have experimented with pillars and have developed the successful dwarf bush orchard. Today the dwarf bush is still with us as our basic intensive system, giving a useful standard when comparing the merits of some of the newer methods now being advocated. Now the spindle bush in its various forms is appearing, involving the planting of large numbers of trees on M IX rootstock at densities varying from 400 to 900 trees per acre.

This is a healthy development. Fruit-growing methods cannot stand still and perhaps we have been slow to exploit the full potentialities of the M IX rootstock which East Malling Research Station first picked out over forty years ago. There is, however, a great deal of discussion about the form our new intensive orchards should take and the precise number of trees per acre that should be planted.

Tree density

The type of dwarf orchard and exact shape of tree are probably not very important. Provided that the rules of good apple growing are obeyed and we fill the available space with good fruiting wood, it matters little whether we elect to grow spindles, centre leader bush, or plain dwarf bush trees. All these systems of training dwarf trees are capable of giving heavy crops of good quality fruit.

Tree numbers are another matter altogether, and here the fruit grower is faced with a dilemma. If they are planted very closely full production can be reached in perhaps as little as five years. We will also spend a lot of money on trees and stakes and may well run into practical difficulties of orchard access and shade as the orchard matures.

If we opt for a more open dwarf orchard it will certainly take longer to reach full production but, there will be no troubles over orchard access and the costs of establishment will be considerably less.

The correct solution to this problem of tree density is never easy, and there is no surer way of going wrong than to copy the man next door or the latest write-up in the popular press. Each site must be taken on its merits and its growth potential assessed. Each variety will also show its own growth characteristics. The grower's personal preference over tree shape and pruning technique must be considered. Finally, the best use must be made of that ever scarce commodity, the capital available.

The good orchard plan demands great care and forethought if it is to solve these problems successfully. Its production is always easier if a systematic method of analysis is used and the following example is offered as a guide to any fruit grower who is faced with the knotty problem of tree density.

There is one note of warning. Although the method may have some merit, the figures quoted will be quite useless when related to any particular fruit farm. The individual fruit grower must substitute his own figures if he is to make a realistic assessment of his own unique situation.

The planning procedure

The object: to establish an acre of Cox which must be fully cropping by the seventh year.

1. *Assess the growth potential of the site.* A vital question. The more intensive the orchard, the more important it becomes to answer this question correctly.

2. *Select the planting distance and rootstock which should give full production by the chosen age.* Choose a distance at which it should be possible to hold the trees without orchard thinning.

Example:

Soil and site: Old Red Sandstone, medium loam.
Good depth and drainage. 26 in. rainfall.
Variety and rootstock: Cox on M IX
Planting distance: 400 trees/acre (8 ft × 14 ft approx.)

3. *Estimate the variable costs of establishment.* At this stage the fruit grower is looking at the broad picture and it should be sufficient to note, perhaps, the first three years' costs when most of the main expenditure will occur.

Table 1 sets out some typical variable costs of establishment at two different plant densities. These costs have been split into two sections—those that are directly related to tree numbers and those that are common to any tree density. By the end of the third year the total variable costs have reached between £400 and £550 per acre, according to the number of trees we elect to plant.

Table 1

The variable costs of orchard establishment at two-tree densities

(3 years only—£5/acre)

	1st year		2nd year		3rd year	
	400/acre	*600/acre*	*400/acre*	*600/acre*	*400/acre*	*600/acre*
A*						
Trees at 7*s.* 6*d.*	150	225	2	3	1	2
Stakes at 4*s.* 6*d.*	90	135	1	2	—	—
Tree ties at 6*d.*	10	15	—	—	10	15
Sundries	5	7	5	7	5	7
Casual labour	10	15	4	6	6	9
Total A	265	397	12	18	22	33
B†						
Fertilizer	10	10	8	8	8	8
Spray chemicals	10	10	15	15	25	25
Sundries	5	5	5	5	5	5
Rabbit wire	10	10	—	—	—	—
Total B	35	35	28	28	38	38
Total A and B	300	432	40	46	60	71
Total variable costs for first 3 years					400	549

*A Variable costs related to tree density
†B Variable costs common to both orchards

The question of the fruit farm's Fixed Cost structure must not be forgotten. Will the new orchard mean an enlarged permanent labour force? Perhaps a new tractor or sprayer will become necessary. What about interest on capital spent?

4. *Estimate future yields and crop values.* This is a very controversial problem. Nevertheless, some attempt must be made and once again the fruit grower should, where possible, make use of local data rather than rely on specific examples from other fruit-growing regions.

Table 2 gives some suggested yields for Cox at two-tree densities under first-class management and good West Midland conditions.

Table 2

Expected yields of Cox on Type M IX rootstock in bushels/acre

(Good West Midland conditions)

Year	*400 tree/acre*	*600 tree/acre*
1	—	—
2	25	35
3	70	100
4	160	240
5	340	500
6	500	550
7	550	550
Total years 1–6	1,095	1,425

In both cases the orchards are shown as yielding 550 bushels per acre at maturity. This is because by the seventh year both orchards should be fully grown; they will completely fill the available orchard space and therefore the effect of tree numbers on yield should have vanished. The important point, therefore, is to note that any benefits brought about by increasing tree density from 400 to 600 trees per acre must accrue within the first six years.

Other varieties will show very different yield patterns. Golden Delicious can out yield Cox by a handsome margin, while Worcester and Lord Lambourne are relatively slow to produce heavy crops.

Future crop values must also be estimated. Here we are only concerned with the tree, and it will simplify the issue if we discount all picking, packhouse, storage and marketing costs and consider the value of the fruit on the tree, awaiting harvest.

5. *Examine the effect of increasing orchard density on the variable costs of establishment and on the cumulative cash flows.* In Table 3 the information from Tables 1 and 2 has been assembled so that this comparison can be made.

Table 3

	400 Trees/acre	*600 Trees/acre*
(*a*) Estimate of variable costs of establishment for first 3 years	£400	£549
(*b*) Total crop for first 6 years	1,095 bushel	1,425 bushel
(*c*) Additional crop from 200 extra trees	330 bushel	
(*d*) Value of additional crop at 10*s.* per bushel	£165	
(*e*) Additional cost of 200 extra trees	£149	

Using these figures it looks as if the 'break even' point to justify the planting of an additional 200 trees is about 10*s.* per bushel. The fruit grower must then decide what he thinks his fruit will be worth and if there will be a sufficient margin to justify the risks involved.

With the variety Cox, because of its high price structure and capacity for quickly coming into crop, such comparisons are often very much in favour of high tree numbers. But now the fruit grower must pause, and really think long and hard about the new project. Has he given a fair assessment of soil and site? Could row width be cut by perhaps a foot, or would this lead to overcrowding and a shady orchard in future years? Perhaps the soil is, in fact, a bit thin at one end of the field where the trees could be spaced a little closer within the row. Do his variable costs present a true picture of the position and has he allowed enough margin on yields and price to take care of the odd spring frost or glutted market?

Finally there is the question of the extra capital involved. Is purchasing 200 extra trees per acre the best way of spending the money, or would a larger area of the less intensive orchard prove a better proposition?

These questions of tree density justify long and careful study. Too much impetuosity can lead to wasted capital and a problem orchard in future years. The methodical approach, coupled with enthusiasm and good business records, will pay good dividends. It provides the only sound base from which to plan our future apple production.

This article has been contributed by **C. D. Walker, B.Sc.,** who is Regional Fruit Adviser with the National Agricultural Advisory Service in Cambridge.

Colorado Beetle in 1968

No breeding colony of Colorado beetle was reported in England and Wales during the year, but the 92 beetles found in various situations was the highest total for over 15 years. The number of beetles found on ships was, by far, the greater part of the total due mainly to high aggregations found on four ships—two from Portugal (8 and 26 beetles) and two from France (5 and 38); beetles were also found on ships from Poland (3), France (1), Germany (1) and on a naval vessel which had called at Gibraltar (2). The following beetles were associated with imported produce—one in a can of black currants and one in canned blackberries from Yugoslavia, one in a Cornish pasty containing processed potato filling from Roumania, one in endive from Spain, one on onions from Hungary and one in a greengrocer's shop where Italian and Hungarian fruit was on sale. Of the remaining two beetles, one was found in a car after a holiday in Spain and the other in an aircraft from Vienna.

Colorado beetle in Europe

According to the latest information from the European and Mediterranean Plant Protection Organization, there has been a further advance by the beetle in Greece, southwards into the province of Trikkala and westwards to the borders of the Ioannina province. In Turkey, the whole of the region of Thrace is now infested, but the beetle has yet to be found in Anatolia. In Yugoslavia, some mountainous areas became infested for the first time.

The Ministry is grateful to everyone who reported the presence of Colorado beetle in England and Wales, and asks for continued support in their campaign against the pest.

H. W. Janson

The Countryside Act 1968

J. R. Rundle

THE continuing process of change in the world in which we live manifests itself in many different ways. Most of the changes which happen around us are physical and visible. Some, however, are invisible; changes in the mental attitudes of the mass of the people, bringing in their train changes in law and in the traditional rights and customs of society.

Such a change is typified by the Countryside Act of 1968. It has been brought about by the increasing affluence and mobility of our society which has put ever-increasing pressure on our countryside in general and the National Parks in particular. It recognizes the need for the public to have the opportunity for recreation in the countryside and the need to ensure that we do not spoil the best of our countryside by overcrowding it with people and motor cars. As a piece of legislation it represents a step forward in freedom for the general public and some erosion of the traditional rights of private property.

In brief, the Act provides for the establishment of the Countryside Commission and the granting of powers to local authorities to set up country parks and to provide camping and picnic sites. It makes provision for the conservation of natural beauty and for wider access to open country, and markedly increases the areas of country which fall within the definition of 'open country'. It makes a number of alterations in the law relating to footpaths and bridleways and provides for the legal regulation of traffic in special areas in the countryside. It enables the Exchequer to give grants towards the cost of providing the various benefits mentioned and, among its various supplemental sections, enables local authorities to make bye-laws regulating the use of special areas of the countryside by the public and to employ wardens to enforce them.

The first part of the Act deals with the establishing of the Countryside Commission. This takes over the functions of the former National Parks Commission together with the various new functions and powers which the Act confers. The keynote to the Act's intentions is the Section that says that the Commission's functions 'are to be exercised for the conservation and enhancement of the natural beauty and amenity of the countryside, and encouraging the provision and improvement, for persons resorting to the countryside, of facilities for the enjoyment of the countryside and of open-air recreation in the countryside'.

Other sections which follow make it plain that the main task of the Commission is to review the problems of providing access to, and enjoyment in, the countryside, of preserving and enhancing its natural beauty and to encourage and assist others, both local authorities and private persons, towards those ends. It has the duty of advising the Minister (of Housing and Local Government) and of carrying out investigations and research and providing publicity and information services. The Commission may itself carry out experimental projects in pursuit of its main aims and may, in the process, acquire and manage land, erect buildings, provide services and carry on any business relevant to the experimental project. Finally, the Commission may give grants, not exceeding 75 per cent, to persons other than public bodies towards any project which in its opinion helps towards the attainment of its aims.

However, the main burden of actually carrying out the principal intentions of the Act falls on local authorities and the next part of the Act deals with the powers which are given to them. Subject to certain rules of consultation with other authorities, a local authority may provide country parks and, within them, facilities and services for the enjoyment of the public and for open-air recreation. The intention behind the provision of country parks is to relieve the pressure on National Parks and other areas which attract great numbers of people, not by making restrictions but by providing counter-attractions. There is little doubt that a well-sited country park, particularly if it contains an area of water, with facilities for sailing, water-ski-ing, etc., will attract large numbers of people. Such facilities the local authority is empowered to provide.

In addition to country parks, local planning authorities and rural district councils may provide camping and picnic sites; it is to be hoped that these will do something to solve the problem of indiscriminate parking in country lanes at the weekend.

In the next part, the Act deals mainly with National Parks and access to open country, and again the task of implementation falls mainly on local planning authorities. The principal section is the one which makes very considerable additions to the previous definition of 'open country'. Under the new definition, open country includes any woodlands and any rivers, lakes or canals (except reservoirs owned and managed by water undertakers or River Authorities and certain canals owned or managed by British Waterways), together with sufficient strips of access land along the banks. This does not, of course, mean that the public has automatic right of access to such places but it does mean that the local planning authority may enter into an access agreement with the owner or may, in the absence of agreement, apply to the Minister for approval for an access order.

A local planning authority may also provide a variety of facilities on land in National Parks, both for serious study of natural history, archaeology and other interests and for public recreation on water, whether freshwater or the sea. It can also make bye-laws controlling the boat traffic on any lake in a National Park.

Another provision in this part of the Act enables the Minister to make an order restricting the right of the occupier of moor or heath land within a National Park from converting it into agricultural land. This restriction requires the occupier to give the local planning authority six months' written notice of his intention, thereby affording the authority the opportunity to

enter into an agreement with him for public access and the preservation of heather. The provision arises mainly out of the controversy over the ploughing of heather on Exmoor and should allow a reasonable solution to be worked out in such cases. Other sections enable the Natural Environment Research Council to enter into agreements for the preservation of special natural features and to make payments for doing so: give water undertakings the power to allow their reservoirs to be used for recreation and to provide facilities for that purpose; and give to the Forestry Commission authority to provide tourist, recreational or sporting facilities. This they are already doing in some places and there is every indication that in doing so they are satisfying a very real demand.

The sections of the Act which deal with footpaths and bridleways are somewhat miscellaneous. Perhaps the least important of the many sections of the Act is the one which confers on the public the right to ride a bicycle (pedal only, no motor cycles) on a bridleway! Of more value perhaps is the section which enables, and in some instances requires, the highway authority to erect and maintain signposts along its footpaths and bridleways. The important sections here are Section 28, under which it is the landowner's duty to maintain stiles and gates across footpaths or bridleways, subject to a contribution of not less than 25 per cent from the highway authority, and Section 29 which lays down rules about the reinstatement of footpaths or bridleways after ploughing. These rules require the occupier of land to reinstate the surface within six weeks after giving notice of his intention to plough and within three weeks after ploughing in cases where he has not given notice. The highway authority may extend the period to three months if the occupier applies and if they think fit but it should be realised that this does not allow the occupier time to take a crop, although it should be sufficient to enable reseeding to be carried out.

Section 32 is a lengthy one, dealing with traffic regulation in National Parks, areas of outstanding natural beauty and in country parks, nature reserves, etc. It is difficult to see how traffic, even in such areas as the Lake District, can be equitably controlled while allowing proper access to residents and those who have business with them but, if a suitable scheme can be evolved, this section provides the necessary legal powers.

Exchequer grants of up to 75 per cent of the approved expenditure of local authorities on various matters under this Act are provided for by the next group of sections and the final supplemental group includes two important provisions; these enable local authorities to make bye-laws controlling the activities of the public in country parks, picnic sites, etc. and enable planning authorities in National Parks to set up and employ a warden service to ensure compliance with bye-laws and with the Litter Act of 1958, and to advise and assist the public generally. Properly implemented, this section should help towards educating the public in the proper way to behave in the countryside.

Two important sections of the Act have not been referred to: these are Section 11 and 37. The first requires every Minister, Government department and public body to have regard to the desirability of conserving the natural beauty and amenity of the countryside. The second requires every Minister, the Commission, the Natural Environment Research Council and local authorities to have due regard to the needs of agriculture and forestry and to the economic and social interests of rural areas. These sections are counter-

balancing and between them they are designed to ensure that the various authorities concerned with the use of land in the countryside take full and proper regard of each other's interests.

The author of this article, **J. R. Rundle, B.A., F.L.A.S.,** is Regional Land Commissioner for the Yorkshire and Lancashire Region of the Ministry's Agricultural Land Service.

The Country Code

The Countryside Commission has produced a new leaflet drawing attention to the Country Code. The Code, first published in 1951, is a series of ten reminders based on common sense and common failings. Its object is to help to reduce and prevent the unintentional damage that often occurs when town dwellers visit the countryside. Those who are unaccustomed to country life tend to forget that a single careless act, such as leaving a gate open or unfastened or dropping a cigarette end or bottle, can cause damage and distress on farms, in forests, or to wild life.

When in the country remember the rules of conduct laid down in the Code.

Guard against fire risks. Plantations, woodlands and heaths are highly inflammable: every year acres burn because of casually-dropped matches, cigarette ends or pipe ash.

Fasten all gates. Even if you found them open. Animals cannot be told to stay where they are put. A gate left open invites them to wander.

Keep dogs under proper control. Farmers have good reason to regard dogs as pests; in the country a civilised town dog can become a savage. Keep your dog on a lead wherever there is livestock about; also on country roads.

Keep to paths across farm land. Crops can be ruined by people's feet. Remember that grass is a valuable crop too; in some cases the only one on the farm.

Avoid damaging fences, hedges and walls. They are expensive items in the farm's economy; repairs are costly and use scarce labour. Keep to recognized routes, using gates and stiles.

Leave no litter. All litter is unsightly, and some is dangerous as well. Take litter home for disposal.

Safeguard water supplies. Avoid polluting water in any way. Never interfere with cattle troughs.

Protect wild life, wild plants and trees. Wild life is best observed, not collected. To pick or uproot flowers, carve trees and rocks, or disturb wild animals and birds, destroys other people's pleasure as well.

Go carefully on country roads. Country roads have special dangers: blind corners, high banks and hedges, slow-moving tractors or animals. Motorists should take extra care; walkers should keep to the right, facing oncoming traffic.

Respect the life of the countryside. Set a good example and try to fit in with the life and work of the countryside. This way good relations are preserved.

Free copies of the new leaflet, and other related information, may be obtained from the Countryside Commission, 1 Cambridge Gate, London, N.W.1. The full Country Code booklet is obtainable from H.M.S.O. (addresses on p. 252) or through booksellers, price 9*d.* (by post 1*s.* 1*d.*).

The advance in productivity in the farming industry over the last twenty years has been due to improved technology and management, both of which have demanded greater knowledge. The author, I. A. M. Lucas, Professor of Agriculture at the University College of North Wales, discusses the need for science and economics in agriculture

University Education in Agriculture

UNIVERSITY degrees in agriculture have been criticized by academics as too much like a description of current practice to be sufficient of a 'mind stretching' exercise and to contain too little science and economics to enable the graduate to evolve new knowledge and skills for the future. Conversely, practical men have criticized graduates because they are not always better farmers than themselves, despite their own considerably greater experience. Friendly criticism stimulates and, although agricultural faculties have never stopped re-appraising courses, I believe that this process has recently accelerated. Consequently the degree is very different from that of 10–20 years ago.

The aims of the University are the stimulation of thought; the generation of new ideas. To do this efficiently, as much as possible must be known of the present. Therefore, enthusiasm for future developments must not crowd current farming practice out of the curriculum. But the main stream of teaching is to show how the sciences and economics may be brought together to explain the success of modern agriculture and to investigate and improve upon its weaknesses. About two-thirds of an undergraduate's time is spent in studying the sciences and economics and about one-third in the integration of these into animal and crop production and farm management.

The 'ideal' agricultural undergraduate is somewhat of a mixture of all things to all men. As a zoologist he learns about the structure of living cells; as a biochemist he explores the immensely complicated chemical changes involved in their growth; the nutritionist in him is interested in the nutrients, such as protein, which must be provided to allow these changes to proceed normally, and the agriculturist is concerned with the ways in which feedingstuffs are used to supply nutrients with maximum technical and economic efficiency, and to produce high-quality meat, milk and eggs. As an agricultural botanist he studies the effect of the spacing of plants and arrangement of leaves so that the crop effectively traps the light, which is one of the raw materials for growth. As an economist he ranges from

economic theory to international policy, or the interpretation of field experiments to give the best decisions on farm management. All these aspects of science are agriculture, and there are many more, such as genetics, bacteriology, parasitology and even electronics. At Bangor, electronic engineers developed further a New Zealand instrument to measure pasture growth. The agricultural graduate must also be something of a mathematician, and has to understand the way in which the results of experiments are examined statistically to appreciate their true significance and value.

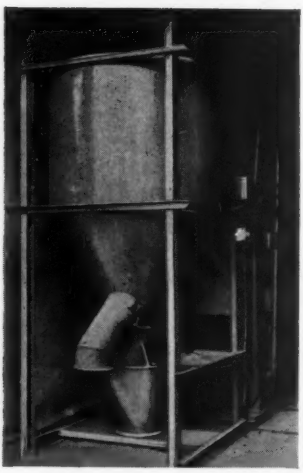
This integration of disciplines is fascinating and is as rigorous intellectually as the detailed study of a single science. Clearly, however, it is not possible to cover all subjects in three years; one dilemma of agricultural education is to reconcile a desire to study in depth while retaining a reasonably broad range of subjects. Inevitably, there must be some specialization, but many think that the best approach to this is by taking another one-year course of instruction after graduating.

The degree in agriculture is not a degree in farming, nor in advising or in research. The graduate must have his 'in-service' training as in other professions. If he is to be a farmer he must work in farming; a university education does not necessarily make him a good 'man-manager' or instil 'business-sense'. If he is to be an adviser he must learn about advisory methods; if a research worker he must know about research methods. But the degree should help a good student to marshal facts, to think, to be healthily sceptical and to have the basic technical knowledge of his trade. This is a common denominator to a wide range of careers in agriculture at home and abroad.

The generation of new ideas involves research, which is as essential for lecturers as for students. A lecturer with a lively interest inevitably wishes to experiment, and this puts more life into his teaching. Also, future research workers need training, and facilities and expertise for this must be provided. Unfortunately, many university departments went through a period when there was virtually no money for research. Even now, university resources are inadequate and there is great dependence upon grants for particular projects from bodies such as the Agricultural Research Council, the Meat and Livestock Commission, the Milk Marketing Board, commercial firms and others. With these grants, university research has increased and may be expected to gather even more momentum.

Finally, some guidance for prospective undergraduates. Agriculture is not a school subject and excellence in sixth form science is not always such a good guide to success in an agricultural degree as it would be to a degree in pure science. Nevertheless, good school performance indicates intelligence, and entrants should aim for at least two good 'A' level grades; for some universities three 'A' levels are required. Any suggestion that the degree in agriculture is suitable only for the 'weaker' students is totally wrong. Each university should be consulted about its requirements and will advise in preferred subjects. In general, these are botany and zoology, or biology, and chemistry. Mathematics and physics are also very useful, and the former may be an essential 'O' level. Usually students taking a degree in agriculture first spend a year on a farm, but this is not always demanded for honours courses in agricultural botany or agricultural chemistry. Its importance to the agriculturists is that they can better understand their lectures by having visual and mental appreciations of the processes described.

They have learned to 'speak the language'. Over the last few years my students have, without exception, said that they have both benefited from and enjoyed the 'year's practical'. It is also noticeable that they are more mature than other new university entrants as they have worked in farming after leaving school. They frequently play an active part in student organizations, which is excellent. University life should be as 'rounded' as possible, and certainly not the mere acquisition of technological expertise.



Combined milling and mixing unit

Automation of Fixed Farm Machinery

Graham Smith

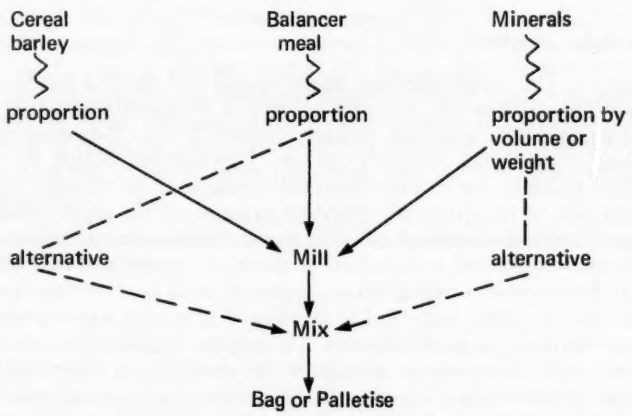
THERE is a tendency these days to talk glibly about electronics, automation, automatic control etc., without really knowing if and how they are related. Electronics is a branch of electricity broadly emanating from the study of radio and utilizing electron flow through a gas, vacuum or solid state material. This means that some form of controlled flow or increased flow of electrons is caused by radio valves, transistors, diodes or cold cathode devices such as neon tubes etc. The question is how can such devices be used to advantage in agriculture.

Food preparation

Preparation of food for farm-scale livestock enterprises can bear a close resemblance to the methods used in the milling and compound feeds

industry. Farms deal in comparatively small quantities, may be fifty tons of concentrated feeding rations per week, which would feed about 4,000 pigs, yet the compounder may be producing fifty tons a day or more. Electronic controls capable of completely and automatically controlling the production of ten different rations simultaneously or in sequence may not be practically or financially possible on the farm. But if one approaches the right people who have the technical 'know-how' and are prepared to think small enough, good quality controls can be obtained at reasonable cost, allowing automated ration production for the larger poultry, pig or dairy farmer wishing to produce his own rations. The cost of commodities today depends to some extent on the number of times they are handled, the distance transported and the wage rate at which these tasks are performed. The saving in handling costs which electronic aids can make contribute usefully to any profit to be made on farm processing.

Typically, farm food preparation includes the processing of home-grown cereal and mixing them with bought-in balancer proteins, plus minerals, proportioned by weight or volume. The product may be bagged up or handled in bulk.



The control of the processes included may be carried out electronically but not on the farm. The more common method used is termed 'electro-mechanical'. Where only one cereal, plus a complex purchased balancer meal, plus a mineral mixture is included, the processing control requirements are simple. A greater accuracy of control can be exercised on the proportioning of the constituents if weighing machines are used. The weighing machines could be kept supplied by means of augers or suitable conveyors and the quantities weighed related to backward counting impulse magnetic counters (high speed is unimportant). The auger can count by means of a magnet and dry-reed switch. Then, when the counters have all returned to zero, the feed augers are automatically switched off. The mill is switched off when the last of the material passes through and the mixer is switched on. According to the setting of a time-switch (non-electronic process timer) the ration will be mixed for say five minutes. Emptying can be done manually, or automatic discharge to a bin can be arranged.

Such an automated programme can be arranged in several ways, all being entirely acceptable in terms of proportioning efficiency but perhaps not acceptable in price. For fifty tons per week a more complicated ration or variety of rations can be produced entirely mechanically or electro-mechanically, or in a very sophisticated way using punched tape, punched card or magnetic tape as the programme. One might say 'but I can get quite sophisticated programming on my washing machine at a relatively low price'. This is quite true, but the power being switched may be only a quarter horse-power motor and perhaps two kilowatts of resistant load, whereas fifteen or twenty horse-power may be involved in the hammermill, five horse-power on the mixer and one horse-power on each of three augers; all these are likely to be on three phase electricity.

As a rough guide to costs, a fifty ton per week electro-mechanical system including a small amount of storage, but not the building, could cost £5,000. Where there is an existing set of equipment, electronic automation control can cost as little as £350. This would include five electric motor controls such as mill auger, hammermill, mixer auger, mixer and bin auger.

Grain drier control

One use of electronics effecting labour-saving and doing a job in a more exact way than labour can normally achieve, is the control of a continuous grain drier to ensure a pre-set moisture content in the off-coming material regardless of the initial moisture content. This can be effected by sensing equipment which in one case measures the conductivity of electricity through the grain and in the other the electrical capacity of the grain. Both these techniques are used in normal moisture meter determinations on both whole and ground samples of grain to an accuracy of $\pm$ 0·5 per cent moisture content. By means of a timing device, usually a clock process type, a sample of grain can be taken, subjected to grinding if necessary, and an electronic moisture test made at short intervals. The results of this test are electrically compared with the reference setting of the control and interpreted by a flow control mechanism at the drier discharge, opening or closing it according to need. Hence the grain flow through the drier is slowed down or speeded up according to how long it is necessary to keep the grain in the drier to obtain the desired moisture content.

A large grain drying installation could be run without attendant labour, assuming there is ample grain available in the pre-drying storage and that the dried grain can be put away into available bins. If any one conveyor in such a plant stopped, the effect is serious enough to require the whole plant to shut down and this can be arranged. If one pre-drying storage bin became empty an alternative could be made to supply the drier. If the oil-burner flame fails or the temperature of the drier falls unduly, the whole plant can be shut down. The diverting of grain from one bin to another can be arranged by the use of proximity sensing devices fitted to the bin; these also prevent overfilling. If necessary, all these devices can be linked into a control system in such a way that if a dangerous situation arises, during the night for instance, the telephone will ring at the farmer's or manager's house, giving an oral message of the fault. In this way whoever is informed goes to the plant with a certain knowledge of what has failed.

Forage feeding

In the automatic operation of forage feeding from tower silos much time and exertion can be saved by load sensing of the silo unloader motor. Load sensing can be built into the controls serving the unloading auger to prevent the unloader digging too deeply into the silage and so tripping out the motor starter relay. If excess current is being drawn by the unloader, a signal is given to the 'raise and lower' motor, causing it to lift the unloader slightly out of work. This enables saving in man-time by making it unnecessary to stand watching the ammeter in readiness to operate the 'lift' motor.

Other applications

Electronics are moving quickly into agricultural practices, such as the control of environment in poultry and pig housing, the recognition of cows and the detection of mastitis at milking time from samples of the foremilk.

Large indoor livestock enterprises, such as fattening pigs, lend themselves to full automation to the extent of enabling one man to supervise the feeding of large numbers. As feeding can be in pen sequence all pigs can be inspected during the feeding period. This can ease the problem of week-end work.

Perhaps one of the most outstanding electronic applications in field equipment is the X-ray stone and clod separator as fitted to a potato harvester. This equipment can reduce labour requirements on a machine from five or six to one, or maybe none at all. Rapid advances are being made with selective spraying machines enabling singling of sugar beet and killing of weeds by visual selection. This is engineered by certain transistors and diodes being caused to conduct electricity when subjected to light reflection. The day of the driverless field tractor is with us, not commercially, but experimentally.

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Disposal of

Farm Waste — Mechanization

In the article 'Disposal of Farm Waste—Mechanization' which appeared in the March issue of *Agriculture* it was stated: 'Many pump units have in the past been fitted with 'choppers'. These are rarely effective with straw or silage. One pump unit has a power driven cutter at the base of the inlet pipe.'

We wish to say that in no way was it intended to infer that this cutter at the base of the inlet pipe is rarely effective for straw or silage, and any misconception that may have arisen from the original statement is regretted.

Farm Gate Selling of Fruit and Vegetables

K. M. Round

UNDOUBTEDLY, goods have been sold by the highway since earliest times. In many cases villages have arisen from such meeting places, but today roadside selling usually means the sale of eggs, honey, fruit, vegetables and other horticultural produce. A seller may be an amateur gardener with surplus to spare. He may be a small-scale grower who has a holding alongside a busy road and sees a way of disposing of his produce for ready cash at holiday weekends.

He may be a grower of a seasonal crop, such as strawberries, and open a stall for the season, or he may develop into a grower trader, selling his own produce as well as bought-in produce. Lastly, he may be a retailer only, buying in all he sells. It is only with the coming of the motor coach and motor car, and the five-and-a-half-day week followed by the five-day week, that this method of selling has assumed quite large proportions.

How it started

The absence of flowers and fresh food between 1939–45 gave a stimulus to some unscrupulous roadside trading practices which worked on the theory that customers are only likely to pass this way but once. The late forties and early fifties must have been vintage years for coach operators, for at this time people were keen to use their increased leisure and greater affluence in getting out of the towns and cities on summer evenings and at weekends but had not become car owners to the extent of later years. It was at this time that stalls advertising local produce mushroomed around well-known beauty spots and on the outskirts of much frequented seaside resorts.

It is not coincidence that tomatoes that require good light are grown close to holiday towns on the coast, and several growers in this situation were to discover that retailing was a more profitable living than growing. Still the importance of quality was not a prime consideration. The genuine grower who bought in lettuce, tomatoes, fruit and flowers to satisfy public demand was offering a service and not offending in the same way as 'spivs', who set up in business in lay-bys and at every possible place along the road in an attempt to make easy money. At this time, coaches passing on the roads were entrapped into stopping by notices displaying bargain prices so that their occupants could be pressurized into buying at a fantastic profit, not the locally-grown produce they expected, but too often the rejects of the nearest

wholesale market. To a certain extent traders of this description are now meeting their match as the travelling population has become more discriminating and the rapidly increasing number of car owners, unlike coach passengers, return with their complaints!

The situation today

The stimulus for the increasing number of stalls along our busy roads now seems to come directly from the growers, farmers, egg and honey producers, who today suffer a sense of frustration when they compare farm gate prices for fresh produce with the high prices obtained for inferior produce within the towns and cities.

Nearly 40 per cent of the price which the consumer pays for fruit and vegetables at a normal retail outlet can be attributed to costs of distribution and marketing. Flowers, too, are a particularly expensive commodity to distribute. Besides taking into account high growing costs, the final price in the shops must also make allowances for a rate of wastage peculiar to the florist's trade. The bulk of horticultural produce is highly perishable and prolonged journeys and rough handling adversely affects the condition of all of it. In spite of the efficiency of our freezing, canning and processing industries there is still a continual demand for good quality, really fresh, food. For many people living in densely populated conurbations the scarcity value alone of such food is enough to put it into the luxury class. On the surface, retailing one's own produce presents an attractive proposition, if there is frontage on to a busy road and it can be done without incurring high capital expenditure.

Equipment

A simple trestle table set up by the road will suffice to hold punnets of fruit. It is possible to pick early in the day, sell at likely busy periods and carry on with the job of growing at other times. This is not entirely satisfactory for anything other than selling one or two lines over short periods, such as strawberries sold during the weekends for a short season. Even then further refinements quickly become desirable; a cover to keep off either the sun or rain, a means of attracting possible customers, and a salesman or woman with patience always at the ready.

Many beekeepers are able to sell their entire output at the roadside, often without an attendant. Although the percentage of profit is high with such a small capital outlay, the volume of sales is limited unless effective and expensive advertising is used. Poultry farmers selling eggs direct to the public generally seem to be able to carry on business satisfactorily without any type of specially constructed selling structure. Provided that the wife is prepared to drop the job in hand to attend to customers when they appear on the doorstep, this extremely easy form of retailing seems to operate quite well with the help of a tolerant wife, a noisy door knocker or bell, and the minimum of facilities and signs. An improvement on the simplicity of this system is the automatic vending machine for eggs which is beginning to be seen around the country. There is still a lot of opposition to these machines by the planners, which is understandable, as they can appear incongruous in rural surroundings. Once this obstacle has been overcome, it is possible to foresee that machines could be used for selling perishable commodities by the roadside, in much the same way that they are used in the towns.

It is the simplicity of the product that enables eggs and honey to be sold without the trimmings of packaging and other forms of elaborate advertising. Fruit, flowers, plants and vegetables respond to impulse buying; the demand by the consumer is created as a result of sight rather than description. A clean, attractively laid out stall or shop displaying good quality horticultural produce at the peak of condition, will reap the reward of time and effort spent on achieving a result with eye appeal.

Restrictions

While it is permissible for a grower or producer to sell the fruits of his own labour from his own frontage without too many rules and regulations, it is different when he starts 'trading', that is to say, when he buys-in other produce and goods, becoming a shop in all senses of the word. It is then that he becomes the subject of numerous acts and must observe a number of rules in the public interest. Like all other shopkeepers he is in duty bound to observe regulations relating to staff employed for selling purposes and to provide them with adequate and necessary facilities.

Planning permission is necessary for any type of permanent building used for selling produce along the roadside, even when it is not in use throughout the year. Local authorities have statutory powers, in addition to parliamentary planning acts, controlling this type of development. In an attempt to support the grower who wishes to sell his own produce from his own frontage, in a simple manner and when it is in season, there appears to be no control on anyone trading by many of our roadsides for only twenty-eight days of the year. These days do not have to be consecutive, so could cover fourteen weekends, thus providing a loophole for far too many roadside sellers who have no regular connection with growing and agriculture and see it merely as a means of making easy money in the summer months. It is often this type of trader that leads to many of the complaints made about roadside stalls.

The main point for consideration with any planning application concerning roadside stalls is that of creating a traffic hazard. Congestion on our road system makes it vital that trading should not be encouraged where such hazards could be easily created. To establish a satisfactory trading arrangement which caters for customers coming from the road it is essential to have adequate car parking, and pulling-in facilities which are well signposted in advance. If a car driver stops on a busy road to make a purchase from a stall he must accept responsibility for causing an obstruction with his vehicle. Action will be taken on the owner of the car and not on the operator of the stall who created the hazard which gave rise to the obstruction. Obviously no business can be created and carried on where every potential customer is warned off by the police!

Space allocated for parking is space well used, and it is highly advantageous if easy access and adequate room is clearly visible for a distance along the road. Established roadside traders agree that the sight of a parked car is like a magnet, drawing in other customers. Sales seem to be stimulated when all the family can leave the vehicle without danger, and where all problems of getting off and back on to the road have been eliminated. Stalls specializing in a strong basic line, such as strawberries, find that they are rather like successful cafés—where customers must be accommodated but are not encouraged to linger too long. Adequate and efficient staff to enable a

quick turn-over to be made, seems to be the basis of both businesses. Garden centres, on the other hand, which are a sophisticated form of roadside trading, are often prepared to use as much space for the accommodation of the car as they do for selling, finding that being able to linger creates an atmosphere conducive to sales and impulse buying.

In these days of 'do-it-yourself', and self-service, it is not surprising that growers are cashing in on the act. In Kent there is a growing tendency for strawberry growers with roadside plots to encourage 'pick your own' selling methods. Adjoining grass is converted for the duration of the strawberry season into a car park and customers are encouraged to make strawberry picking into an excursion and pleasurable experience. Cream and sugar are often sold with the fresh picked fruit while toys are occasionally provided for the amusement of younger members of the family and the children of the regular pickers. It is certainly an idea which appeals to the public. Damage caused by inexperienced weekend and evening 'pickers' seems to be amply compensated from the cash return and rapid clearance of the crop without labour headaches.

Notices indicating that selling is taking place are also necessary at the roadside stall. Unless one lives in a rural area of special beauty, which has been so designated and therefore no commercial advertising is allowed, it is permissible for a sign not exceeding 12 sq. ft to be displayed indicating that goods and livestock produced on the holding are for sale. To attract a motorist passing at 35 m.p.h., lettering 2 inches high will only be visible for one second while the car travels 50 ft—not much time in which to establish demand and slow down before stopping. It is, therefore, not surprising that without the guidance of specific regulations governing such advertisements and signs so many are crude and an eyesore. 'Runners from certified maidens' may make sense to a strawberry grower, but remains a cause of amusement for the majority of passers-by. The same can be said for 'Oven-ready rabbits and Alsatian puppies', while one wonders what type of animal it is that produces 'Rabbits eggs, for sale'. It is possible that the recently introduced Trades Descriptions Act may mean a premium for the grower-trader who can state with honesty 'strawberries grown here' as opposed to just 'Strawberries sold here'. It is not good business for inaccurate signs to be left in position from one season to another; just as 'open' should mean 'open' so should 'Tomatoes for sale' indicate that tomatoes are readily available to be bought every day the sign is in position. While few advertisements are inaccurate, the meaning of many are open to misunderstanding. A sign 'Eggs at 3*s*.' would generally be considered to relate to the standard quantity of a dozen, but in fact it may well mean only half a dozen, or eggs of minute size.

Advertising

Roadside selling in its most advanced and efficient form is becoming as acceptable as other methods of marketing. In order to attract customers from towns into making special journeys to garden centres and the large multi-shop selling units which are now beginning to appear in certain rural areas following the American pattern, advertising by all the popular mediums, including television, is being used. No longer is the element of chance enough to attract customers in the number necessary to recover heavy expenditure on attractive premises and running costs. While advertising in a local paper may not be helpful to the man selling only one or two crops over a very short period to a

passing trade, it can assist in establishing a business which is going to be carried out on a permanent basis. It can be used to effect in the case of the genuine farm shop which operates in exactly the same way as the town counterpart; the principal difference being that the shop situated in the country will be open throughout the weekend, during the evenings, and on the whole also have longer working hours. To cope with this it appears that in rural areas there is a large and easily available labour supply of married women who enjoy part-time work, and can cope with the situation. The seasonal and small direct selling business which is run on a holding usually depends for its success on freshness, quality and price to establish a reputation, which is then passed around by word of mouth. Successful growers and retailers who trade at the roadside year after year tell me that *regular* customers form the backbone of their trade and are just as likely to arrive in a 'Rolls' as a 'Mini'.

Some pitfalls

For the small grower who wants to grow and sell at the same time there are many pitfalls. The man who successfully carries out a retail business from his holding is an exceptional person with a gift for management and very probably a loyal, hardworking wife, family and staff, who are all prepared to give the support during the evenings and weekends demanded by this type of trading, as well as tolerate the inconveniences so created. There is the possible pitfall of doing neither the job of growing nor that of selling properly. Outlets for poor quality produce are difficult to find if the best is always destined for direct sale. Wastage can become a problem in which it is difficult to make the necessary adjustment, and this can influence quality control. Demand from a passing trade is not easy to anticipate, and there is constant pressure to change established growing patterns in the hope of making extra profits. Friends and neighbours expect you to handle their produce. You will be asked to take on additional lines by customers and well-meaning acquaintances which could easily mean the introduction of expensive accommodation such as a deep freeze or, as in the case of bananas, anticipate a quick turnover if a profit is to be made. It is only as a result of keeping careful and accurate records over several seasons, which should take into account man hours (so often overlooked by small scale growers with families), that the success or failure of any trading venture of this type can be assessed.

Advantages

One big advantage for the grower with his own stall is that it provides him with a source of ready cash; no one expects to find a credit system in operation at the shop by the roadside. It enables him to know exactly what the consumer is looking for, and now that bulk buying has become fashionable and deep freezers in the home are on the increase, he is in a very good position to supply this increasing trade. He should know all about the produce he sells, when it is at its best, variety names, why one apple is better than another, and when the price will be right for jam-making. This is the type of information which gives the grower many advantages over his counterpart in the city, but the final consideration is the personality of the man himself, on which so much will depend. The public are notoriously hard masters who come in a variety of types and temperaments, while growers generally consider themselves to be self employed and answerable only to

themselves. The customer who arrives by car for her fruit, vegetables and flowers has the right to expect the same standard of cleanliness and quality control she now finds in the supermarket; she expects to find the courtesy of the old-fashioned family grocer, and a degree of freshness unobtainable elsewhere which justifies the effort of shopping at the roadside. Many such customers have at some time had experience with the unscrupulous dealing which has tended to dominate this type of marketing and it is only mutual confidence and trust that will establish satisfactory business relationships.

This article has been contributed by **K. M. Round, N.D.H., Dip.Hort. (Reading),** who is the County Horticultural Adviser for the National Agricultural Advisory Service in Kent.

The Ministry's Publications

Since the list published in the April, 1969, issue of *Agriculture* (p. 181) the following publications have been issued.

FIXED EQUIPMENT OF THE FARM LEAFLET

No. 25. The Implement Shed and Farm Workshop (Revised) 2*s.* 3*d.* (by post 2*s.* 7*d.*)

FREE ISSUES

ADVISORY LEAFLETS

No. 54. Black Bean Aphid (Revised)
No. 170. Thrips on Peas (Formerly Pea and Bean Thrips) (Revised)
No. 245. Apple and Pear Scab (Revised)
No. 268. Plums (Revised)
No. 269. Cabbage Aphid (Revised)
No. 310. Fluke or Liver Rot in Sheep (Revised)
No. 428. Preparation and Trussing of Poultry for Market (Revised)

SHORT TERM LEAFLETS

No. 15. Chemical Weed Control in Top Fruit Orchards (Revised)
No. 18. Rearing Replacement Pullets (Formerly Modern Rearing Methods for Poultry) (Revised)
No. 19. Choosing Selective Weed-killers for use on Cereals in the Spring (Revised)
No. 81. Harvesting Strawberries—a work study investigation in Kent (New)
No. 82. Chrysanthemum Varieties for Heated Glasshouses (New)
No. 83. Chemical Weed Control in Carrots, Parsnips, Parsley and Celery (New)

The priced publication is obtainable from Government Bookshops (addresses on p. 252) or through any bookseller. Single copies of the above free items are obtainable from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex.

Part of the meat display in one of the stores

Henry Galazka, an economist with Messrs. J. Sainsbury Ltd., discusses that firm's requirements of home-killed meat and how such requirements are determined by a combination of first-hand consumer needs and what the farmer can produce economically.

Home-killed Meat

On the advent of self-service it seemed to be the fashion to discuss its effects on the meat trade as a new and potent force which would unify all consumers' requirements into joints of one particular size and shape. At the same time—it was said—this force would somehow induce a parallel degree of uniformity in the breeding and production of livestock on the farm to meet the new demand in the form of 'animals of the kind suitable for supermarkets'.

We would not subscribe to this view. In our experience the housewife does not change her requirements merely because she purchases her meat in a self-service store, and the comparison of supermarkets with traditional counter-service shops shows that the variation in the individual housewife's requirements has remained as great as ever. Nor is this surprising when one considers differences in household size, family income, eating habits, or tastes. On the supply side, variations in the type of livestock produced have arisen in the past and will continue to arise from differences in the natural conditions on farms, which for economic production have led to a variety of breeds and/or managements, in each case designed to make the best use of the particular farm resources available.

One can, of course, visualize that ultimately the results of the work of geneticists and husbandry specialists, coupled with very large production units, will accelerate the trend towards greater uniformity in livestock production. However, in our view, the reality of the present situation is that, in a national sense, a wide area of choice for the distributor will continue to exist for a considerable period of time.

Against this background, Sainsbury's requirements are determined by the combination of continuing first-hand experience of consumer wants and an appreciation of what the national farm can produce economically. There is a difference in the mechanics of procuring supplies of meat for our branches as between beef and lamb on the one hand and pork on the other. Pigs are mainly bought direct ex-farm from producers, and the Company itself slaughters and converts the carcases partly into fresh pork and partly into manufactured products and cured meats. In the case of beef and lamb, supplies are obtained in the form of dressed carcases from suppliers who themselves buy and slaughter; a proportion of pig carcases is also obtained in this way.

Although the mechanics between pigs and other livestock differ, the principles are the same. In all cases, purchases conform with established quality standards, and buying is conducted through arrangements with a limited number of regular suppliers who are selected on the basis of their ability to meet the standards. The arrangements provide a direct and continuous contact with suppliers which is regarded as an important element in the Sainsbury link between the farm and the shopping basket. All purchases pass through a process of screening at slaughter to assess suitability, and it is the function of carcase evaluation teams to provide (by cutting, weighing and, when necessary, by full dissection) the assessments needed in greater depth to judge the suitability of new potential sources of supply or of different types of animal.

Carcases or meat are often classified or described as 'quality'. Given the wide range of consumer and trade requirements, the word quality as a term denoting acceptability or an unspecified standard of excellence is, of course, meaningless. Sainsbury's prefer to think in terms of the range of qualities that is available, each with its own price. Hence, the Company's approach to meat is based on the concept of 'value for money', and this appears to come much closer to the truth of the situation. Indeed, if one were to sum up the firm's aim and function in meat retailing it could perhaps be best put as an attempt to achieve the optimum value for money for the section of the community that it serves, coupled only with a deliberate refusal to handle meat which falls short of its standard.

It is certainly not the intention to imply that the meat trade has not changed or will not change. It is rather to suggest on a balanced assessment that changes in the types of animal used for meat will come slowly and gradually—partly because one can detect no radical changes in the broad requirements of the consumers, and partly because any changes on the production side through either genetic progress or drastically different management must of necessity themselves be slow. Neither would we wish to argue that our own experience necessarily mirrors that of other meat retailers; there is clearly room for a variety of trading policies in the complex world of meat, and in any case our direct experience is largely restricted to the southern half of England, i.e., the area in which the Company operates.

In assessing the suitability of any carcase for his trade, a meat retailer will generally take account of two main factors:

1. the physical yield of saleable joints, which will reflect the proportions of the various cuts, and their composition in terms of lean, fat and bone; given that the meat is of adequate appearance, these data provide an immediate indicator of the competitiveness of the cost of the carcase.
2. the eating qualities of the meat, and hence the degree of satisfaction that the purchase is likely to give the consumer.

Each of the two broad factors is itself made up of a number of individual characteristics, but for simplicity one could perhaps label the two elements 'carcase' and 'meat' respectively.

Both factors, of course, operate right across the whole meat trade, but the relative importance of the various characteristics will vary as between beef, pork and lamb. The trader will always compare his purchase with the 'ideal', but it is a sad fact of life that the ideal is rarely found. Hence all judgments are compromises, and if they are to be rational he will need to attach varying 'weights' or priorities to the different characteristics that he needs to assess. The meat characteristics are more difficult to judge objectively than those of the 'carcase', but this by itself should not be an excuse for giving them a lower priority.

It has always been a matter of Sainsbury's policy to attach sufficient importance to the eating characteristics of meat to ensure as far as possible that the meat from carcases bought will satisfy the consumer. To this end, cooking and tasting tests are conducted as a matter of routine, and the results are taken into account along with the data of physical yield. A special reference must be made to flavour. Some people would have us believe that concern for good flavour is a waste of effort, and that the consumer does not really care as long as the meat looks all right on the counter and proves reasonably tender after cooking. We have always disagreed strongly with this view. It is generally agreed that Scotch beef fattened in North East Scotland has superior eating qualities, and such beef regularly commands a premium—at times, substantial—on the market. It is admittedly difficult to isolate flavour from other eating characteristics, notably succulence, but nevertheless, a substantial part of this premium must attach to flavour, and this example alone—and there are others—would not appear to support the contention that all consumers are alike and that flavour is of no consequence.

We describe the selection of meat for our shops as the result of a search for the optimum in terms of suitability and value. This description seems even more apt in the context of guiding selection for genetic improvement. In evaluating the different sets of characteristics as part of a breeding programme, there is also a clear need to strike a balance which will represent an economic optimum. We would not, of course, pretend that this is an easy problem; heritabilities of individual characteristics vary, and we know that by selecting for some of the desirable physical characteristics of animals we may at the same time be selecting against others which are also advantageous. For example, at any given slaughter weight within breeds, higher lean contents tend to be associated with higher bone content and lower kill-out percentage. More important conflicts arise in the clash of desirable characteristics of the 'carcase' with those of the 'meat'. Good flavour and succulence are rarely found in carcases which lack adequate finish; flavour tends to develop with age, hence selection for faster growth may tend to conflict with the development of fuller flavour; fast growth and tenderness will go together

but for a given period of hanging it will be difficult to maximize tenderness and full flavour in the same animal.

In this respect the Meat Research Institute and the Meat and Livestock Commission have a large area of urgent work to carry out in order to help the industry to achieve a better understanding of the problems and to find the correct solutions. This will inevitably take time, but in the meantime, the industry, through impatience, may be tempted to tackle the problem of genetic improvement solely along the lines of shorter-term economic advantage, i.e., faster growth and higher lean contents, even though these gains may be achieved at the expense of meat qualities.

From the point of view of the long-term interests of the meat industry we can see dangers associated with under-estimating the importance of meat quality characteristics. The possibility of central pre-packing, which will lead to more economic operation of self-service stores, has broadened the awareness of meat quality criteria; most of all, however, in the longer term we can see dangers arising from ignoring the need to maintain or—better still—improve the eating qualities of meat, if the consumption of meat, and particularly red meat, is not to decline in the face of competition from newer foods.

This article has been contributed by **Henry Galazka, B.Sc. (Econ.)**, who is an economist with Messrs. J. Sainsbury Ltd.

'Food Statistics'

A new guide to Food Statistics has been published in booklet form by the Food Manufacturing Economic Development Committee.

This guide, which lists both official and unofficial sources, has been compiled to provide a simple index of all the sources of statistics relating to the food manufacturing industry. The amount of statistics available is very much greater than is generally realized, and the guide outlines not only the variety of this information but also lists the coverage and frequency of appearance of each series.

This is the first time that such a comprehensive guide to statistical information relating to the U.K. food manufacturing industry has been made available, and it is believed that this should prove to be an invaluable aid to all firms concerned with the production and marketing of food. It will complement the forthcoming guide to official statistics on food and agriculture which is being prepared by the Ministry of Agriculture, Fisheries and Food.

'Food Statistics' is available free of charge from the National Economic Development Office.

The use of nitrogen on grass to stimulate a vigorous growth throughout the season should be the objective for

Intensive Beef Production

R. B. Mair **S. C. Meadowcroft**

On most commercial farms nitrogenous fertilizers are used on grassland to increase the stock carrying capacity. More nitrogen is used to produce more grass and then more stock are used to eat the extra grass. The increase in stocking density is achieved either by bringing more stock on to the farm or by keeping the same number of animals on a reduced acreage. Results from some recent investigations at three Husbandry Farms suggest that, with young beef cattle, this type of development may not be the most profitable way of using nitrogenous fertilizer.

On many farms running commercial beef enterprises, increased applications of nitrogen have been associated with increased levels of stocking. Under commercial conditions it is, therefore, virtually impossible to determine whether any improvement in the profit per acre is the result of using extra fertilizer, as it may be due solely to the increased stocking rate. There is, therefore, a lack of reliable information upon which to determine the most profitable combination of nitrogen usage and stocking rate for intensive beef grazing enterprises. To provide this information, a series of co-ordinated trials began on three Husbandry Farms in 1965.

The experiments

The essential feature of each trial was the comparison of the performance of young beef cattle grazed at a range of stocking rates on plots receiving 50, 175 or 300 units of nitrogen per acre.

At Trawscoed, yearling crossbred heifers were used. These weighed about 500 lb at turnout, and the stocking rates ranged from 1·0 to 3·0 beasts per acre.

At Rosemaund and at High Mowthorpe, Hereford × Friesian steers, weighing around 400 lb at turnout, were used. The range of stocking rates was 1·2–3·6 beasts per acre at High Mowthorpe, but at Rosemaund higher levels of 1·67–5·00 beasts per acre were studied. At each farm in each year there were nine grazing groups. Each group consisted of five beasts at Rosemaund and High Mowthorpe, and of four beasts at Trawscoed.

The experiments were sited on young leys and were run for three years on the same sites. The groups of cattle were rotationally grazed over six paddocks, all of which received the appropriate level of nitrogen. Stock were moved from paddock to paddock every $3\frac{1}{2}$ days. Surplus grass was conserved as silage, at least two of the paddocks on each treatment being mown for a full silage cut in May and the remaining paddocks being closed up and mown later in the season. All paddocks were topped during the second half of the season. The standard of management given to the stock and the grass was felt to be equivalent to that achieved under good commercial conditions.

Grazing results

The performance of the cattle in the trials at Rosemaund and at Trawscoed tended to be at a higher level than that of the cattle at High Mowthorpe. The longer growing season and milder climate in the West apparently resulted in more vigorous grass growth and better rates of liveweight gain from the cattle. Nevertheless, the trends shown up by the results were markedly consistent at all three centres.

It was apparent that any increase in the stocking rate, at any one of the three levels of nitrogen, reduced the individual performance of the cattle; this result was expected. It is a well-established fact that animals grazing together in a group are, to some extent, competing against each other. The effects of this competition increase as cattle are more heavily stocked.

In the HUSBANDRY FARM experiments the inclusion of extra cattle improved the total weight gain per acre except at the top end of the range of stocking rates, where the decline in individual performance was so severe that little or no improvement in the total output per acre was achieved by the addition of extra cattle.

The second major trend showing up in the trials was that the application of extra nitrogen improved the individual performance of cattle, when compared at equal stocking rates. This result was not expected.

It is a common belief that whilst high levels of nitrogen will produce more grass, the nutritive value of the grass is lower than that produced from less heavily fertilized swards. It is held that whilst more cattle may be kept, the individual performance will be depressed. The HUSBANDRY FARM experiments suggest that this belief is a misconception, arising from observations made on commercial farms, where any increase in the level of nitrogen applied tends to be accompanied by an increase in stock numbers. The effect of nitrogen is confused with the effects of increasing the stocking rate.

Implications of the grazing results

Whilst it is important to achieve a high output per acre by grazing at a high rate of stocking, the individual animals in a grazing group must achieve a satisfactory rate of liveweight gain. At the end of a grazing season large numbers of badly grown animals are unlikely to be as profitable as fewer animals of better weight and condition. Experience on the husbandry farms suggests that in a semi-intensive beef enterprise, using autumn-born calves weighing 400 lb or over at turnout, liveweight gains of less than 250 lb/head during the grazing season are unacceptable.

Animals which do not achieve a satisfactory rate of gain on grass are expensive to feed to a finish in yards; they have a low value at the end of the

grazing season. It is therefore more profitable to obtain a high total weight gain per acre with a few well grown beasts than with a larger number of animals whose individual performance is low. This can be demonstrated by examining data derived from three years' trials at High Mowthorpe.

In addition to being weighed, all the cattle were professionally valued at the beginning and end of each grazing season. Tables 1 and 2 show some of the effects that different levels of nitrogen and stocking rate had on the average total liveweight gain per acre and on the average appreciation in the cash value of the stock grazing an acre of grass.

Table 1

Total liveweight gain over the grazing season

lb per acre (mean of three seasons, 1965–1967)

Units of N per acre	Stocking rate—Cattle per acre		
	1·8	2·4	3·0
50	475	446	—
175	553	599	609
300	—	654	711

Table 2

Appreciation in value of stock over the grazing season

£ per acre (mean of three seasons, 1965–1967)

Units of N per acre	Stocking rate—Cattle per acre		
	1·8	2·4	3·0
50	16·5	9·2	—
175	22·9	16·9	13·9
300	—	27·3	23·1

Table 1 shows that when 175 or 300 units of nitrogen were applied high total weight gains were achieved at the high stocking rates. Table 2 shows that these did not necessarily produce high financial benefits, as the appreciation in value of the cattle declined as stocking rate increased. It is apparent that using high stocking rates to maximize the physical production per acre does not necessarily lead to maximum profit per acre.

The data can be used to estimate what combination of nitrogen and stocking rate would result in the best financial return. Table 3 summarizes the average results achieved, over three years, on five of the treatments in the High Mowthorpe trials. The results are expressed both in physical terms, of individual daily gain and total liveweight gain per acre, and in financial terms as the average appreciation in value, per head and per acre. The cost of buying the appropriate amount of nitrogenous fertilizer at a standard value of 8½*d.* per unit is also shown.

Table 3

Effect of stocking rate and nitrogen on liveweight gain and appreciation in value at grass

Treatment	Stocking rate	Nitrogen	Mean liveweight gain		Appreciation in value		Cost of nitrogen
			Total	Individual			
	Cattle per acre	Units per acre	lb per acre	lb/head/day	£ per head	£ per acre	£ per acre
A	1·8	50	475	1·55	9·2	16·5	1·7
B	2·4	50	446	1·10	3·8	9·2	1·7
C	2·4	175	599	1·49	7·0	16·9	6·0
D	2·4	300	654	1·61	11·4	27·3	10·3
E	1·8	175	553	1·82	12·7	22·9	6·0

Taking treatment A in Table 3 as a base line, the data can be used to assess the effects of increasing stocking rate and nitrogen level. Treatment B shows that to increase the stocking rate to 2·4 cattle per acre without increasing the nitrogen would be unprofitable, because the performance of the cattle was poor. Treatments C and D show that it was necessary to increase the nitrogen level to 300 units per acre before the adverse effects of the increase in stocking rate were overcome. Treatment E shows that by increasing the nitrogen level to 175 units per acre without any increase in stocking rate the performance of the cattle was improved. This in turn produced an increase in the appreciation in the value of the stock.

In order to find a more profitable treatment than A, which was 1·8 cattle with 50 units of nitrogen per acre, the choice lies between treatments D and E. Treatment D, 2·4 cattle with 300 units of nitrogen per acre, produced an appreciation in value of £27·3 per acre, with a nitrogen cost of £10·3 per acre. On treatment E, 1·8 cattle with 175 units of nitrogen, the appreciation in value was £22·9 per acre, with a nitrogen cost of £6·0 per acre. When the figures are adjusted for the differential expenditure on nitrogen it is evident that treatment E is preferable, as a similar net appreciation per acre was achieved with a lower capital investment on both stock and fertilizer. In the experiment the nitrogen was applied mainly to promote the growth of grass for grazing. In practice, the need to achieve high yields of grass for silage-making would mean that the optimum level of nitrogen would be increased to over 200 units per acre.

These calculations pre-suppose that the stock are to be sold at the end of the grazing season and therefore make no allowance for the value of the silage or hay conserved during the summer. When cattle are yarded to be finished on winter rations which are based on conserved fodder and supplementary cereals an increase to a higher stocking rate can cause further problems. The available fodder has to provide for more animals and the more densely stocked cattle will be lighter at yarding. They will, therefore, either have to be sold at lighter weights or be kept for a longer period in yards. A bigger weight of cereals will be required to compensate for these factors and food costs will be higher. This increase in food costs means that the margin per head will tend to fall as stocking rates are increased. The cost of providing extra housing must also be considered.

Improved performance at grass by sensible use of nitrogen can lead to improved profits. However, the net effect of increasing stocking rate is similar whether cattle are sold as stores or taken through to finish, in that any increase in stocking rate that results in a much reduced level of performance by grazing cattle is unlikely to be profitable. The results of the trials on the EXPERIMENTAL HUSBANDRY FARMS suggest that with the paddock grazing systems used, the stock carrying capacity of the two farms in the West was higher than at High Mowthorpe. At Rosemaund and Trawscoed it appeared that with 300 units of nitrogen per acre, cattle stocked at $2\frac{1}{4}$–$2\frac{1}{2}$ beasts per acre gave a satisfactory level of performance on grass. This represents a live weight of cattle of 1000–1200 lb per acre at the start of the grazing season. At High Mowthorpe performance declined sharply at stocking rates of over 2 beasts per acre; it appeared that a turn-out weight of 800–900 lb per acre was all that could be reasonably supported.

Pattern of application of nitrogen

Work at High Mowthorpe suggests that with autumn-born calves weighing around 400–500 lb at turnout, at stocking rates of $1\frac{1}{2}$–2 cattle per acre, one third of the grass should be grazed in spring whilst two thirds are mown in May and early June. Further conservation cuts will be possible in late June and July, but the bulk of the grass produced from June onwards is required for grazing.

With this system the amount of nitrogen required to support satisfactory liveweight gains at grass and in yards without excessive supplementary feeding is likely to be 200–300 units per acre over the season.

The whole area should be given 100 units per acre in March or early April, whether it is for grazing or silage. Where early haymaking is planned, the nitrogen to the grass for spring mowing will have to be kept to below 40 units per acre. The spring grazed area will require further top-dressings. Up to 60 units of nitrogen may be needed after each grazing. This area has to carry a heavy stocking of cattle up to the time that aftermaths are available from mid-June onwards. By the middle of June the spring grazed area, one-third of the total, may have received 250–300 units of nitrogen per acre.

Silage will have been cut and cleared from the remaining area in late May or early June. As soon as possible this area should be top-dressed with nitrogen and potash; further top-dressings are given as the season progresses. Thus the spring grazed one-third receives the bulk of its nitrogen before the end of May, whilst the mown area is given a higher proportion of its nitrogen during the second half of the season. The amount of nitrogen given should be varied according to conditions. The objective should be to use nitrogen to stimulate a vigorous growth of grass throughout the season, and so maintain a satisfactory level of liveweight gain with intensively stocked cattle.

This article has been contributed by **R. B. Mair, B.Sc.**, and **S. C. Meadowcroft, B.Sc.**, who are respectively, Farm Director and Deputy Director of the N.A.A.S. High Mowthorpe Experimental Husbandry Farm at Duggleby, Malton, Yorks.

The medium for the investment of funds available to the farmer is vitally important in the field of farm management.

The Management of Farming Capital

W. J. Dunford

ONLY in more recent years have studies in the field of farm management tended to move away from their earlier pre-occupation with profitability as a measure of the economic performance of the farm as a productive unit to a fuller consideration of profitability as a measure of the yield obtained from capital funds deployed in the business of farming. The distinction thus made between the trading activities of the farm business and its rôle as a medium for the investment of funds available to the farmer is, however, a vitally important one which is essential to any proper understanding and appreciation of the function of capital management. A farm business, for example, may conceivably achieve a measure of profitability in its trading activities while at the same time exhibiting weaknesses in its overall financial structure which, if not corrected, could threaten the stability of the business as a financial entity and, eventually, its very existence. This could very well be the case where an undue proportion of the funds used in the business are likely to be withdrawn at short notice or where realized profits are being misapplied. The possibility of this latter situation arising is of particular significance in the context of the typical family farm where the respective demands of the domestic and business sectors often directly compete for available funds.

The ultimate aim of farm financial management should, therefore, be to ensure that the assets of the business are held in forms which are consistent with the sources of the funds from which those assets are derived. Its function, in the pursuit of this aim, is to exercise appropriate control over the employment and deployment of the additional funds which are at the disposal of the farmer in successive periods in the life of the business, whether these funds are in the form of generated profits, further capital introduced, or of additional credit facilities optionally available to him. In this context profitability as an objective is seen not as an end in itself but, more appropriately, as the most important means of servicing, maintaining and augmenting the capital funds invested in the farm business.

Effective management control in any sector of the farm business will depend on the availability of adequate records but, fortunately, in the case of the majority of farms, the indispensable basic document for financial management will already exist in the form of the farm balance sheet. The importance of this financial statement as a management aid will perhaps have already been conveyed, by what has been said above, to those with some knowledge of the content and construction of the balance sheet. For others, that importance will readily become apparent after a brief statement of the two main functions of a balance sheet. First, it provides both a concise picture of the volume and the nature of the assets held by a business at a given point in time and a record of the sources of the funds with which those assets were acquired; secondly, it registers the volume and disposition of the additional funds available to the business during the accounting period ending with the date at which the balance sheet was struck. By the very nature of its purposes and functions, therefore, the farm balance sheet is capable of yielding valuable information concerning the relationships between the various components of which the financial structure of the business is comprised; information which, in turn, provides the necessary setting for future management decisions. In making these decisions, moreover, the 'flow' function of the balance sheet can be used to review recent allocations of funds and to project and assess the effect of various investment and production alternatives on the future financial structure of the business. Many farmers will doubtless consider themselves ill-equipped to use their farm balance sheet in this way but it is hoped that this article will help to dispel such a view. Naturally, some knowledge of the main features of a typical farm balance sheet and its construction is required but the following brief description should provide an adequate basis for the analysis procedure outlined in the rest of the article.[1]

The division of the balance sheet into two separate schedules which list respectively the assets and the liabilities of the business will probably be familiar even to those with the most casual acquaintance with the document. The assets of the business comprise those items of value which are actually owned by the business, together with any claims which it may have on items of value in the possession of others. Perhaps the most important way in which these various assets will differ from one another is in the facility with which they can be turned into readily usable cash; it is the normal practice to list these assets on the balance sheet—either in ascending order or descending order—according to their degree of 'liquidity'. Assets normally appearing on the farm balance sheet will, therefore, range from land and property (and the improvements embodied in them), which obviously possess a low measure of liquidity, to 'near-cash' assets such as products awaiting sale and business debtors and, finally, to cash itself, held either in hand or in the form of balances on current account at the bank. Assets which occupy an intermediate position on this scale of liquidity are represented by such items as breeding livestock, machinery and immature crops and livestock.

For the purpose of financial management, assets are usually classified as being either of a 'fixed' or 'current' nature. Fixed assets are those which are not used up or materially transformed within the span of a single production

[1]A detailed description of the 'flow' aspects of balance sheet analysis, as well as an expanded treatment of those aspects dealt with in this article, will be found in *The Farm Balance Sheet: Its Construction and Interpretation* by G. D. D. Davies and W. J. Dunford, *Report No. 167*, Department of Agricultural Economics, University of Exeter.

cycle but which yield their production benefits over a series of such cycles; current assets consist of those assets which, in the normal course of events, will be processed and eventually realized in the form of cash within the period of the production cycle. In the case of the farm business, therefore, fixed assets will usually include land, buildings, plant and machinery, and breeding livestock, while current assets will comprise livestock other than for breeding, harvested and growing crops, and items of deadstock other than machinery—the physical working assets, in other words—together with the liquid assets represented by trade debtors and cash balances. Thus, to summarize: liquid assets plus physical working assets equal current assets; and current assets plus fixed assets equal the total assets of the business.

The liabilities of the business represent the claims which may be made by bodies or individuals upon the funds invested in the farm business in the form of assets. They will consist of money owed or borrowed by the business which, sooner or later, will have to be repaid to the creditor or lender concerned and it is usual to list these according to the period of time within which repayment will have to be made. Claims which the business will have to meet, or be prepared to meet, in the short period are known as current liabilities and will normally include bank overdrafts and other short-term loans and trade creditors, while longer-term claims are represented by debt capital in the form of fixed interest term loans and mortgages. The last claim to be met, of course, will be the owner's capital balance (the net worth of the business). This will appear on the liabilities side of the balance sheet, if the farm business is solvent and assets exceed external liabilities, by virtue of it being the residual claim which the owner, as a lender to the business himself, would have against the realized funds of the business in the event of it being liquidated and all prior claims to that of the owner having been met. Where external liabilities exceed the realizable value of all assets then the business is said to be insolvent and a capital balance is then replaced by a capital deficit. This is listed on the asset side of the balance sheet being, in effect, the amount which the farmer would owe the business on liquidation.

From this short account of its main features it will be seen that a balance sheet is capable of being reduced, in its most simple form, to the following accounting equation:

$$\textit{Owner's capital} + \textit{Liabilities} = \textit{Total assets}$$

or, if the business is insolvent:

$$\textit{Total liabilities} = \textit{Total assets} + \textit{Capital deficit}$$

Using the main categories of assets and liabilities distinguished earlier, it is now possible to expand the first of these two simple equations (which fortunately represents the situation more commonly met) as follows:

$$\text{Total liabilities} \left\{ \begin{array}{c} \text{Owner's capital} \\ \textit{plus} \\ \text{Long-term debt capital} \\ \textit{plus} \\ \text{Current liabilities} \end{array} \right\} = \left\{ \begin{array}{c} \text{Fixed assets} \\ \textit{plus} \\ \text{Current assets} \end{array} \right\} \text{Total assets}$$

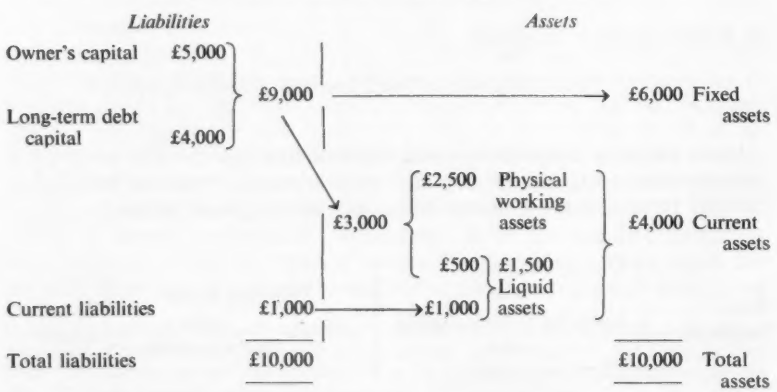
Expressed in this manner the equation shows how the funds of the business have been deployed in the form of assets. For the most part it is not usual for funds from particular sources to be allocated to specific assets and it is not inappropriate, when constructing a balance sheet model, to visualize it as possessing an hour-glass shape. This serves to emphasize the essential funnelling process within the business structure whereby funds are acquired from various sources in the form of liabilities and then distributed over a range of farm assets.

Nevertheless, because the claims of all lenders to the farm business must eventually be met by the transfer of funds out of the business in the form of cash, it is important to examine the general relationships which exist between the broad categories of capital sources and those of assets in terms of the readiness, on the one hand, with which the various types of assets held can be made to realize their value and of the imminence, on the other, with which the claims of lenders of funds to the business are likely to be presented.

Investment in fixed assets will obviously commit funds for relatively long periods of time and it is imperative, if the business is to avoid the gradual erosion of its capital base and the probability of eventual insolvency, that these funds should be derived from corresponding long-term sources. These will consist principally of the owner's personal stake in the business and of fixed interest term capital, and the minimum amount of capital which should be provided by these sources is normally regarded as being determined by the volume of fixed assets in the business. In contrast, current assets are being continuously transformed into cash in the course of the farm's production cycle and, consequently, they can—in part at least—be funded by relatively short-term credit. However, as at any given time only a part of current assets will be held in fully liquid form as immediately available cash balances, it is clearly advisable for a proportion of current assets to be financed from sources which are not likely to seek early repayment if the situation is to be avoided where physical working assets would have to be realized prematurely in the event of short-term creditors pressing for settlement.

The further modification of the basic balance sheet equation now set out below will perhaps make it easier for the reader to assimilate these relationships:

Farm business capital: Source/outlay relationships



In this diagrammatic representation of a balance sheet, current assets are seen to exceed current liabilities so that a substantial proportion of the former have clearly been financed from long-term sources which more than adequately cover the fixed assets of the business. In this way the risk of the current assets of a business having to be realized to meet short-term claims is obviously reduced, but may not be entirely removed if too small a proportion of the current assets are held in the form of fully liquid funds in relation to the level of short-term liability claims. In the example, however, liquid assets are seen to exceed the total of the short-term claims and physical working assets thereby freed of any threat of premature realization.

These comments will have served to introduce a few of the more important relationships within and between the asset and liability structures of the farm business which should be kept under constant observation in the management of its finances. Any exhaustive study of the financial structure of a business will, of course, involve the exploration of many more relationships than those briefly described here and involve the use of a number of the financial ratios which have been devised to throw these relationships into sharper focus. However, it is suggested that the working farmer might well aim—without too much difficulty—to become conversant with at least three of these ratios as a means of exercising better financial control over his business and of ensuring its stability both in the long- and short-term.

The first of these basic ratios is the 'net capital ratio' which is concerned with the long-term position of the business and expresses the relationship between external liabilities and total assets. It is calculated by simply dividing the total assets of the farm business by its total liabilities less the owner's capital (or net worth), as in the following example which is derived from the 'source/outlay' model:

$$\text{Net capital ratio} = \frac{\text{Total assets £10,000}}{\text{Total liabilities £10,000 } \textit{less} \text{ Own capital £5,000}} = 2:1$$

Some measure of the asset cover available to meet the liabilities of the business is provided, quite simply, by the existence and magnitude of the capital balance, as owner's capital is calculated by deducting total external liabilities from total assets. But the net capital ratio is a more convenient means of assessing the degree of security which is available to the farm business in the longer term, particularly if comparisons are to be made with the position of other businesses or with the business's own past financial positions, as it enables a ready appraisal to be made of the amount by which the value of the farm assets would have to decline before that value is exceeded by the liabilities of the business other than the owner's own capital. In the example ratio set out above, therefore, the value of assets would have to fall by a half before that value was equalled by the external liabilities of the business. A fall of a similar magnitude in the value of the assets in a business with a narrower net capital ratio would clearly place that business in a precarious position, even though its capital balance were the same as in the above example (i.e. £5,000) as it would not be able, if forced into liquidation, to meet its external liabilities on realizing its assets.

The safety of the business in the shorter period can be explored by means of two other simple ratios. The first of these, the 'current ratio', measures

the relationship between current assets and current liabilities and, again using figures from the model, is calculated as follows:

$$\text{Current ratio} = \frac{\text{Current assets £4,000}}{\text{Current liabilities £1,000}} = 4 : 1$$

If current liabilities exceed current assets then the business is rendered vulnerable in the short-run, even though its long-term position may be fundamentally sound, because it runs the risk of having to dispose of fixed assets in order to meet short-term claims, thereby impairing the production potential of the farm business. But even an apparently healthy-looking current ratio could be misleading if, as has already been stated, too small a proportion of current assets are in liquid form and, for this reason, it is important to pay constant attention also to the 'liquidity ratio'. This provides a measure of the cover afforded short-term creditors by current assets which can be readily turned into cash and is simply obtained by dividing liquid assets by current liabilities. In the terms of the model, therefore:

$$\text{Liquidity ratio} = \frac{\text{Liquid assets £1,500}}{\text{Current liabilities £1,000}} = 1{\cdot}5 : 1$$

As a general rule farmers should endeavour to ensure that their short-term financial position is not jeopardized by the existence of current and liquidity ratios which are too narrow, although it is necessary always to bear in mind that the latter ratio, in particular, is susceptible to variation which may be entirely of a transitory nature. Furthermore, it is broadly accepted that the larger the proportion of current assets held in liquid form, the narrower can the current ratio be.

It will be noted, however, that no attempt is made to suggest precise ratios at which farmers should aim as the 'safe' level for any given ratio will vary according to the type of business operated, with the composition of the main categories of assets and liabilities of the business and with the personal attributes and circumstances of the farmer. Nevertheless, the procedures described should enable the individual farmer to formulate 'guideline' ratios for his own particular type of farming venture and permit the periodic assessment—and, if necessary, the correction—of his financial position so that the general trend of recorded ratios may be one of improvement rather than deterioration, even though temporary departures from such a trend may be unavoidable.

But, if such exercises are to be of real value, certain precautions must be observed. First, before any ratios are constructed, the existing values of the assets which appear on the balance sheets being used should be examined and revised if they are thought to reflect inadequately current realizable values; secondly, conclusions should not be drawn from any ratio change without reference to the underlying changes which may have occurred in the separate components from which that particular ratio has been derived; and, lastly, it should be recognized that trend indices constructed from a series of ratios compiled over a period of time will inevitably provide better guidance than ratios derived from a single balance sheet. If these safeguards are adopted, then the practising farmer will find himself much better equipped to manage

the financial aspects of his farming business and, in particular, to allocate future funds—whether these be in the form of profits or externally derived capital—between private consumption, production expenditure, the repayment of borrowed capital and the various forms of farm and off-farm investment open to him.

This article has been contributed by **W. J. Dunford, B.Sc. (Econ.) (Lond.)**, a lecturer in the Department of Agricultural Economics, University of Exeter. For many years, whilst a member of that Department, he has taken a special interest in the use of farm accounting records for management purposes.

Farm Incomes in England and Wales

A Report based on the Farm Management Survey for 1967

Average net income per farm increased appreciably on most types and sizes of farms in 1967, and more than restored its decline in 1966. This is shown in 'Farm Incomes in England and Wales in 1967', published by H.M. Stationery Office.

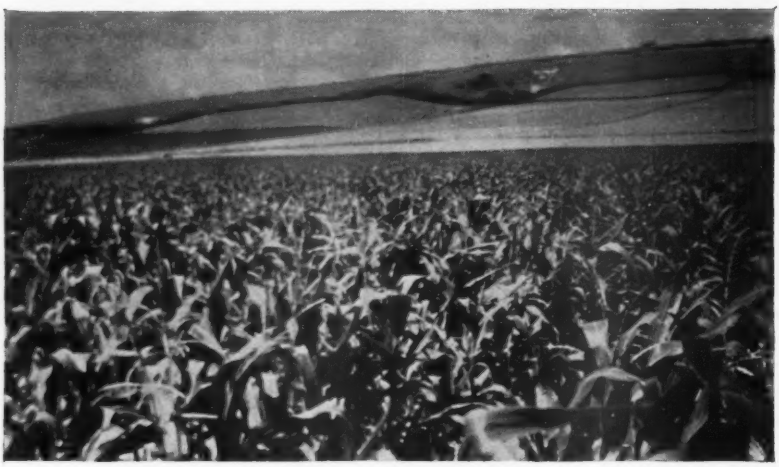
The Report is based on a sample survey of about 2,500 full-time farms and relates to a financial year ending, on average, early in 1968. Although cultivations and sowings were delayed during the winter of 1966/67, subsequent growth of cereals was satisfactory and crops in 1967 were harvested under good conditions. Yields of roots were slightly lower, but hay and silage crops were good in many areas. Returns for most livestock were higher, but maincrop potato prices were lower than in 1966.

Income comparisons 1966 and 1967

Net income is the return to farmer and wife for their labour, and the use of their tenant-type capital. Average net income on all types (except horticulture) taken together increased by about 18 per cent from £1,912 in 1966 to £2,251 in 1967, but there were variations between types.

Net income on dairy farms rose by nearly 19 per cent to £1,867. Increased costs on these farms were outweighed by higher milk output (due to slightly higher prices, increased in herd size and yields) and better returns from cattle sales. On sheep farms incomes rose by some £3,000 per farm or 35 per cent; and on cattle and sheep farms by more than 40 per cent to £1,672. These farms sold more animals at higher prices than in 1966 and feed bills fell slightly. Experience on arable farms varied. Income on cereal farms recovered to its level of 1964 and 1965, about £3,000. On general cropping farms, incomes were adversely affected by lower prices for maincrop potatoes and increased expenses, particularly rent, and were practically unchanged at about £3,600. Mixed farms benefited from the better returns for cereals and livestock and, despite increased costs, their average income rose by nearly a third to £2,800. The average incomes of horticultural holdings and of pig and poultry farms also rose.

Copies of the publication may be obtained from H.M. Stationery Office (addresses on page 252) price 16*s.* 6*d.* (by post 17*s.* 4*d.*).



Crop of maize growing below the Mersley Downs

23. The Isle of Wight

P. R. Peachey

THE Isle of Wight is synonymous with tourism, holidays and, more latterly, hovercraft, in the minds of most people, but few realize that its exports include milk, grain and horticultural products, some of which are still regarded as exotic.

The advantages of climate are more important to horticulture than to agriculture, and the high intensity of winter light gives a near ideal situation for glasshouse production. Already far-seeing businessmen are establishing some of the most modern nurseries in the world, producing carnations, roses, chrysanthemums, tomatoes and cucumbers on a grand scale. Most of these are situated on greensand soils, just south of the chalk downs which run from east to west almost through the centre of the island. Great care is being taken by planting trees and shrubs to make them unobtrusive and so preserve the scenic beauty and rural charm for holiday visitors.

North of the downs the majority of the soils are heavy and cold and drainage is a continuing cost. Here, livestock farming predominates, especially dairying and there are still many family farms with small herds.

Dairy farming is the backbone of the island's farming and where a few years ago Channel Island breeds were in the majority, the Friesian has now succeeded. Mild winters and a rainfall of about 30 inches per year allow a long grazing season and this is, on average, late March to mid-November. In a few very sheltered areas early bite is regularly taken in late February. Intensive grazing management of dairy herds has taken hold and quite a number have stocking rates of one or less acres per livestock unit. There are also areas of downland rising to above 760 feet where the herbage and natural flora is no more productive than much of the hills in the north and west of the country.

There are no native breeds of sheep, but for several generations the Dorset Horn held sway. The number of breeding ewes has been steadily diminishing since 1959 and this is likely to continue as land prices continue to rise. Prices of land on the island almost match those on the mainland, quality for quality. What slight difference there is, is partly a reflection of the problem of transport into and out of the island. Nevertheless, improvements are continuously being made and horticultural products picked in the island one day can be in markets all over Britain by the next morning.

One of the crops which is grown almost exclusively for export is sweet corn. This crop, which is marketed between mid-July and mid-October, has a high labour content, as each cob has to be hand picked. When picking finishes the remains of the crop are ensiled to produce a very palatable and cheap feed for cattle. Parallel with sweet corn is grain maize which has been developing slowly and in a small way over the past few years and is now being grown commercially by a few farmers. It is a crop that has now become possible on suitable soils, through the efforts of plant breeders who have produced hardier and earlier ripening strains. Chemical weed control and relative freedom from cereal diseases makes it possible to grow it for several years in succession. For these reasons Island farmers have one more break crop than their colleagues in the north. Yields approach the two ton per acre mark, and fifty hundredweights has been known. Winter beans are rarely grown because of the risk of chocolate spot disease; spring beans are also liable to attack. Potato blight usually strikes on the island earlier than most places in the south and east of the mainland and consequently the bulk of growers take early precautions against this disease. Sugar beet has not been grown since 1964, because of the haulage cost involved in taking the crop by boat to the mainland. Strangely enough, the island has been able to trade favourably with the Continent in the export of barley. Once in a boat, it is as easy to take it across the Channel as it is to a British port.

The Royal Isle of Wight Agricultural Society holds a one-day show each July, and though this is well thronged with holidaymakers, it is still very much appreciated as a high point in the Island's agricultural calendar.

National Survey of Cow Kennels

L. M. Parsons *Agricultural Land Service, London*

BECAUSE of the difficulties of reconciling widely-varying opinions on the dimensions and costs of kennel structures, the A.L.S. carried out a survey last winter of sixty-two dairy farms where kennels had been in use for some time in an attempt to establish some common standards and reasons for unsatisfactory performance.

Effects of weather

The possible effect of weather was first considered. Fifty-three of the farms were in the western half of England and Wales, forty-one in areas with average annual rainfall exceeding 35 in. and nineteen in districts where 50 in. of rain are common. Prevailing wind and rain was from the West in fifty-five cases and in twenty cases the farms were above the 500-ft contour. It was

surprising to find that although more than one-half of the kennels were on new sites they were in exposed situations. Those on sheltered sites were nearly all in or alongside existing buildings, while all but two of the total number were used only for the winter housing period of 4–6 months.

The great majority of the kennels were thus in localities where more conventional housing might have been expected to be found. Rainfall and exposure would not, therefore, appear to be a major factor in deciding whether or not to use kennels. Nevertheless, care is necessary in planning because generosity in providing concrete yards usually results in problems of runoff and slurry handling.

Breeds and herd size

Of the sixty-two farms included in the survey, forty-nine had herds of Friesians, four of Ayrshires and nine of the Channel Islands breed. On fifty of the farms the herd size fell into the 30–90 range but five farms were below and seven above this range, the latter including a herd of more than 200 and another of more than 300.

Milking and herd management was carried out by one-man units on forty-one farms, two-man units on twenty and eight-man units on the remaining one. In the case of thirty-four of the herds, cows in milk and dry cows ran together all the time. Cowshed batch milking was practised on fifteen farms and bails were used on ten others. The remaining thirty-seven farms had milking parlours—twenty-three abreast type, two tandem, eleven herringbone and one chute.

Row density of kennels varied with forty-five farms favouring either two or four rows. Ten, however, had single rows while the remaining seven had six or more rows. Kennels would thus seem to be satisfactory for any herd or size of herd.

Constructional details

Although all the buildings surveyed had kennels of proprietary make, details varied considerably. Timber framing with corrugated iron roof sheeting was the most popular but steel framing was used in a few cases. Timber was generally preferred for side and end cladding.

One-third of the structures had eaves height of less than 6 ft and over one half were in the range 6–7 ft with only four in the 8–9 ft range. While low eaves height obviously represented a substantial saving it could lead to difficulty where tractors fitted with safety cabs have to be used within the building. In such cases a minimum height of 9 ft is now recommended.

Because the majority of the herds were Friesian, the most popular size for the bed was 7 ft $\times$ 3 ft 9 in. Generally, however, the dimensions of bed and gangway were similar to those recommended for cubicles. In fourteen cases where the beds were between 7 ft 4 in. and 7 ft 9 in. long no trouble was experienced. Gangways were generally of the recommended width of 8 ft but on sixteen farms the width was less than 7 ft 8 in. and over 8 ft 3 in. on six others. For the main frame either 3 $\times$ 3 in. timber or $1\frac{3}{4}$ in. OD steel tubing was the most popular.

No forced ventilation was used and condensation had occurred only in two cases. Nearly all the buildings had an open ridge 8–12 in. while several had eaves gaps of 4–6 in. and ventilation posed no problem even in rapidly changing weather conditions.

Thirty-six farms relied entirely on natural lighting but no difficulties during darkness were reported. Very few, nineteen, had artificial lighting installed and left on at night.

Despite the wide range of sizes and conditions there was no evidence of unsatisfactory use or performance.

Bedding materials

Combinations of straw shavings and sawdust were most frequently used but on nineteen farms chalk with a loose covering such as straw, ashes or sawdust was employed. In only two cases were solid sleeper beds without any additional material used. In some cases straw was added to beds of hard earth, dung or hard chalk to prevent cows throwing out the base material when getting up.

Costs

These can be subject to wide variation depending on site requirements.

For the kennels alone the survey showed a range of £7–28 equivalent to 3*s.*–14*s.* 6*d.* per sq. ft or £8–25 per cow. This gives an average of about £15 per kennel, 6*s.* 1*d.* per sq. ft and £14 10*s.* per cow.

For erection, the costs varied from 10*s.* per cow on a prepared site to £25 where site works such as concreting, effluent and rainwater disposal and provision of a new parlour had to be carried out.

Conclusion

The main findings of the survey can be summarized as follows:

1. Cow kennels whether of timber or steel have developed to the point where they are really cubicle houses with partitions forming an integral part of the building or roof structure but allowing more latitude on layout detail. Cow kennels, however, appear to lack the flexibility which is inherent in cubicle housing.
2. Large open layouts must be avoided so that there is no problem of slurry disposal.
3. No complete failures were revealed although minor constructional faults were observed.
4. Exposure, where a nuisance, can be overcome by infilling ends with straw bales, hardboard, timber, or other inexpensive materials.
5. With use of pressure treated timber and sufficiently sturdy main members, kennels can be constructed to last for years at less expense than a conventional building with cubicles inside.
6. Nevertheless, kennels are a specialized form of building for housing stock not readily adaptable for other purposes. Before deciding whether greater flexibility ought to be provided, a cost/benefit analysis would be desirable. Generally, however, the system appears to have a wider part to play than was originally thought at an attractive cost provided its limitations are recognized.

Acknowledgment

The author wishes to acknowledge the help of Mr. W. H. Dempsey, A.R.I.C.S., Regional Farm Buildings Advisory Officer, Northern Region in interpreting the survey results.

in brief

- **New Norfolk Agricultural Station**
- **Formic acid silage**
- **Wild duck**
- **Some facts about stupefying bait**
- **Testing agricultural p.t.o. shaft guards**

New Norfolk Agricultural Station

A FRESH chapter in the story of the Norfolk Agricultural Station has opened with the centre's move to Morley St. Botolph. Since 1924 until the late 1940s the siting of the Station at Sprowston could not have been bettered, but as the disrupting tentacles of Norwich stretched further and further into the countryside during the past ten years, the conduct of experimental work there became steadily more difficult, notwithstanding every precaution that could be devised. Clearly it was time to look around. So when Manor Farm at Morley, about three miles outside Wymondham, came on the market it was bought by auction in July 1965, and the not inconsiderable undertaking of transferring operations to the new site was begun.

Morley, covering 430 acres, is much the same size as Sprowston, and for the most part the top soil, a sandy loam, is very similar to that at the old Station. The subsoil, however, is a clay loam, as opposed to Sprowston's brick earth or gravelly soil, which means that seedbeds may be a little more difficult to prepare. On the other hand, the water retention of the heavier subsoil should eliminate the dangers of severe summer droughts and thus benefit experimental work, which will continue to be directed to problems generally associated with the light and medium soils of the county.

Mr. A. C. Owers, Director of the Station, has explained that all indications suggest the arable land can be divided into three distinct areas. On the northern boundary the land is relatively free draining and little heavier than the majority of the fields at Sprowston. The central area is still suitable for all the crops normally grown at Sprowston, but the soil is probably more typical of the medium loams of central and south Norfolk than of the light sandy soils found in Breckland and parts of east Norfolk. On the southern side there is an area of stronger land where potatoes might give trouble at lifting time but where beet is still a worthwhile proposition. 'Our present proposals', he said, 'are that a rotation similar to that used at Sprowston will be operated on the greater part of the farm, but that the heavier land will be used to investigate problems that occur on a simplified corn and beet rotation. This should give admirable facilities for a much closer examination of those problems related to continuous cereal growing and the need for break crops. Because of these distinct divisions, the new farm will be able to cater directly for a higher proportion of Station members than has been possible in the past'. The beef cattle enterprise (mainly for the production of 18-month-old beef) will be expanded, using a paddock system on a 30-acre strip of disturbed soil running through the centre of the farm.

Until such time as the existing buildings can be replaced by modern ones, adaptation must suffice, although with the equipment loaned by the Meteorological Office a new meteorological station has already been set up which will ultimately replace that at Sprowston. By the generosity of a member of the Station one of

the large rooms in the office block has been turned into a well-appointed meeting room. Here, too, will be housed the Station's unique collection of books on Norfolk farming—a priceless record that mirrors the age-old agricultural skills of East Anglia. It is hoped that anyone who can will add to this library, for in the same way as we are indebted to past generations, so those to come may be indebted to us.

Formic acid silage

It may look good and it may smell good, but the real proof of the silage, as with the proverbial pudding, is in the eating. Additives in silage-making engender a good fermentation, greater palatability and a higher feeding value; and it therefore follows that the production response should be higher. The yardstick for their use, however, as with any other marginally tight practice, is whether the end profit justifies the means.

The Great House Experimental Husbandry Farm at Helmshore in Lancashire put it to the test in 1967 when they compared wilted grass treated with formic acid with untreated grass, all cut on 28th June and picked up by forage harvester the following day and ensiled in adjacent concrete bunkers covered with polythene sheets weighted by bales of hay.

When the silos were opened on 6th March, 1968, chemical analysis, digestibility trials with wether sheep and a feeding trial with heifers demonstrated the formic acid silage to be of superior quality. It was sweet and pleasant, had a high lactic acid (7·3% compared with 4·7% for the untreated), a low pH and a 60·6% digestibility of dry matter (compared with 55·3% for the untreated). At £20 per ton, the difference between the two silages worked out at £29 per hundred tons of herbage, or about 6*s*. per ton of grass carted—which is roughly equivalent to the cost of applying the additive into the flail chamber of the harvester. Nevertheless, other things being equal, the greater daily liveweight gains made by the heifers during the feeding trial is a pointer to profitability that is worth considering.

Wilted herbage, if properly consolidated, can usually be relied on to give a good silage without the use of additives, and it will be of interest therefore to learn the results of new trials at Great House this year which compare silage made from wilted herbage and silage from *fresh cut* material treated with formic acid.

Wild duck

There is a great potential in this country for what we might call organized wildfowling—ponds, wet gravel pits and reservoirs, to say nothing of thousands of little streams, springs and marshy corners, that could be deliberately and skilfully managed to provide the right conditions to increase wild duck numbers. Wildfowling is an age-old sport unconnected with social status, and it is the purpose of a new, well-illustrated booklet, *Wildfowl Management*, issued by the Eley Game Advisory Station, Fordingbridge, Hants. (price 4*s*.) to show how best Nature can be assisted to ensure this extra crop. The whole spectrum of habitat requirements, not only a convenient sheet of water, must be studied, including nesting and brood cover, food supplies and safe resting areas. Also the annual replenishment of young mallard stock must be of a good wild strain if they are not to become 'too tame, too fat and too cosseted'. Three aspects are discussed in the booklet—the construction of flight ponds (usually an easy matter), rearing and the provision of breeding areas, supported by experience at Fordingbridge. The enterprise adds another dimension to farming and one which will excite enthusiasm among sportsmen who are looking for something more than merely going out with a gun.

Some facts about stupefying bait

The Ministry recently announced that there would be a limited extension of licensing to assist farmers and growers who wish to use stupefying bait to give local

protection to pea and brassica sowings and seedlings under attack by wood-pigeons. Naturalists and others concerned with the conservation of our native animals and birds have expressed some misgivings about this decision and there also seems to be some misapprehension about the object of these operations.

The bait to be used consists of tic beans treated with the stupefying substance, alpha-chloralose. Research has shown that tic beans are reasonably attractive to wood-pigeons and will not be taken readily by many other birds. There is still some slight risk to game birds but if they do take the bait 80–90 per cent of them recover. In twenty-eight trials carried out by the Ministry using tic beans, 1,914 wood-pigeons were taken for the loss of ten game birds, and six other protected birds died. Rodents such as rats and mice may take the bait, but in practice only mice have ever been found dead. Searching the area for stupefied birds greatly reduces the risk to predatory mammals and, in fact, no cases of harm to such animals have been revealed during the course of the many trials conducted during the past six or seven years. Fears have also been expressed about a possible risk to racing pigeons. Racing pigeons do not normally feed on agricultural land and, in fact, none has ever been taken in any trials carried out to date.

It is important to get the use of stupefying bait into proper perspective. It is not a panacea, and certainly its use on a wide enough scale to reduce the whole country's wood-pigeon population could never be contemplated. The best it can do is to offer a useful alternative to other techniques designed to minimize damage, e.g., shooting with decoys over vulnerable crops, or scaring. Even so, wood-pigeons are unpredictable and it is probable that not all bait-laying will be successful. An element of chance remains.

A careful watch will be kept on these operations. Only the farmer can decide when it is opportune to lay the bait, but he is required to notify the Ministry within 24 hours of doing so. An inspection will then be made to ensure that the conditions of the licence are being observed.

Testing of Agricultural Power Take-off Shaft Guards

The use of power take-off shaft guards, in accordance with the Agriculture (Power Take-off) Regulations, 1957, has prevented many serious accidents. The effectiveness of these components, however, depends on their satisfactory operation, and failures due to wear or fractures may render them highly dangerous, without this being apparent to the operator.

Now, a British Standard specifying a test which indicates faults in guards which might render them dangerous in use is published as a part of BS 3417 *Agricultural power take-off shaft and guards*. This is Part 5: 1969 *Testing of power take-off shaft guards* and has been prepared in metric units.

The form of results of the test specified in the standard indicates the robustness and durability of a p.t.o. shaft guard for general agricultural use. It provides for the simulation of those environments and types of usage which are known to be common causes of guard failure.

The four-part test is suitable for p.t.o. shaft guards which are supported on the p.t.o. shaft, is equally applicable to rotating and stationary guards, and is not affected by the method of attachment to the shaft. Characteristics tested are durability, and resistance to low temperatures, to impact loads and to side loads. The new standard describes these tests and also specifies in detail a 400-hour running test in a variety of simulated environments. An appendix provides the form of test report required.

Power take-off shaft guards tested in compliance with this British Standard require to be marked with a number of relevant details.

Copies of BS 4317 Part 5 may be obtained from the BSI Sales Branch at 101/113 Pentonville Road, London, N.1. Price 6*s*. each (by post 7*s*. to non-subscribers).

AGRIC

Fellowships in Agricultural Marketing

Two fellowships in agricultural marketing will be offered by the Ministry of Agriculture, Fisheries and Food in 1969. The fellowships will be tenable from October, 1969, for a period normally not exceeding two years at any University or other Institution in the United Kingdom acceptable to the Ministry. They are designed for men or women of good honours degree standard who may have had industrial or commercial experience rather than research experience. The value of a fellowship will depend on various factors but up to £2,000 per annum may be granted. Further details are given below.

Applications should be addressed to **Advisory Service Division, Ministry of Agriculture, Fisheries and Food, Room 277, Great Westminster House, Horseferry Road, London, S.W.1., to arrive by May 31, 1969.**

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

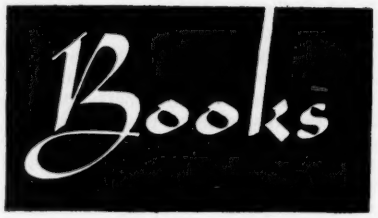
Diseases of Vegetables

Bulletin No. 123

The commercial producers of vegetables must frequently find himself at a loss as to the cause of failure in his crops, and this is where Mr. Lawrence Ogilvie's experience can be of very great assistance. Far too often failure is due to disease—fungal, bacterial or virus—and could be avoided if the right remedy were applied at the right time.

Under a main heading—Diseases of Particular Vegetable Crops—each vegetable is named and the diseases to which it is prone are described, so that the producer can recognize the cause of his particular failure. A further section—Control Measures—then gives the methods most suitable for the control of the various diseases named.

This bulletin, containing 110 papers, was first published in 1941 and is now in its sixth edition, having again been revised and brought up to date by Mr. Ogilvie. It is illustrated in both black-and-white and colour and is obtainable from H.M. Stationery Office (addresses on p. 252) or through any bookseller, price 12*s.* 6*d.* (by post 13*s.* 4*d.*).



Insect Resistance in Crop Plants. R. H. PAINTER. University Press of Kansas, 1969. 40*s*. (Paperback).

Dr. Painter's book was first published in 1951 and is a classic text-book on its subject. Stocks of the original edition were exhausted several years ago, and the present printing is a word-for-word copy of the original, differing only in the inclusion of a new preface in which, in 1½ pages, the author emphasizes the increased interest shown in non-pesticidal methods of lessening insect damage in recent years. He is reassuring about the development of insect 'biotypes' able to feed on crop varieties which may have taken many years of costly experimental work to produce: to date, only six such plant-insect relationships are known, and these occur mainly where resistance is conferred by a single genetic factor. Most cases of insect resistance have complex genetic bases, and no difficulties with biotypes have occurred.

There is, presumably, always space on library shelves for classic text-books; original or reprinted. But this is not to say that students should be encouraged to buy a paperback edition which ignores the past seventeen years of research and investigation during which it has become clear that many of the older resistant varieties of crop plants were found by 'hit-or-miss' methods of field selection. Latterly, improved understanding of plant genetics and of insect biology has led to several cases of reasonably good practical field resistance to pests even though we still know little about the biochemical/physiological bases of resistance; as Beck (*Ann. Rev. Ent., 10,* 1965) states: 'In the past, studies of the mechanisms underlying plant resistance have always come after the fact of resistance'. In short, there seems a clear need for a new text-book which should set out, for students, the principles leading to the development of crop plants that are deliberately designed for pest resistance; there is plenty of scope: Beck's bibliography lists 179 papers on mechanisms underlying insect resistance alone and only about a dozen of his citations are common to Painter's 40-page 'selected supplementary bibliography' which, of course, does not include papers published later than 1950.

Typographically, this reprint is a success; photographically, it is not so satisfactory and there are several cases, for example, Figs, 13, 43, 50, 63, where art paper would have probably improved the rendering of detail and contrast.

A.H.S.

The Inviolable Hills. ROBERT A. DE J. HART. Vincent Stuart, 1968. 42*s*. 6*d*.

In these days when agricultural science, armed with hormones and chemical controls, is tending to become the art of defeating the normal laws of nature, it is appropriate that a book of this kind should appear to remind us that we may go too far in upsetting the sensitive balance of animal and plant life. The author reminds us that monoculture has its dangers and that pesticides can be misused, but in saying this it is a pity that he overstates his case. 'Worms tend to be killed by chemical fertilizers' for instance would be difficult to substantiate under normal farming conditions, in fact they are increased by proper fertilizer practise on grassland. Both farmer and conservationists would support his plea that the development of land should not necessarily destroy natural beauty and that planning should take into account the balance between food production, forestry and water supplies.

Mr. Hart's assertion that Britain's uplands could be converted into prosperous agricultural areas will be applauded by many, but his techniques for hill land improvement are very vague and not those usually recommended by most authorities. To suggest that 'artificial drainage is undesirable' and 'little or no lime is needed' is surely applicable to only a limited area of hill land in Britain. It is not often that statements in the same book are contradictory; on page 50 the author quotes Lord Boyd-Orr who wrote that hill sheep deplete the hills of minerals through their sale off the farm, but on page 153 he says that the 'high mineral content of rain water more than compensates for the loss of soil nutrients occasioned by the annual removal of sheep'.

Although only a minority will agree with all that has been said in this book, the vast majority of us would surely concur with his plea to operate in harmony rather than in conflict with the forces of nature.

C.H.M.

Organisation and Administration of Agricultural Research. I. ARNON. Elsevier, 1968. 80*s*.

The Director General of F.A.O., in the opening sentence of his foreword, declares that this critical and comprehensive examination of the many difficult problems of agricultural research organization and management is a valuable contribution to the relatively sparse bibliography on a subject of fundamental importance. How right he is.

The author, Dr. Arnon, is the Director of Volcani Institute of Agricultural Research in Israel. In opening, he reminds readers that agricultural research is not only probably the first but also the most widely spread form of organized research in the world. He spotlights the truism that agricultural research, by its very nature, must be regional. There is not the needless duplication throughout the world that uninformed persons may think and do sometimes claim.

In general, the book surveys the organization of agricultural research in a number of countries, examines them in detail, and makes recommendations. This has been done in a most penetrating manner and is clearly the kind of analytical work necessary if it is to command that respect which its impartiality justifies and deserves.

There is so much of great value in the book that short extracts from it cannot begin to do justice to the whole. It is, as the title implies, a reference book for those who have a responsibility for, and interest in, agricultural research and is worthy of study by them even though they may have long years in such work.

Those engaged in agricultural research are often called upon to justify their work in economic terms. This is most difficult. The author quotes Olin's index of returns and other formulae used to that end. His warning that a formula, however well-planned, must be based on reliable ingredients, is to the point, and is sometimes overlooked.

Altogether an admirable book deserving widespread circulation and close study.

C.R.

Wood Dictionary. (Vol. 3). Elsevier, 1968. £9 10*s*.

A book compiled by a 'Sworn International Expert' cannot fail to be authoritative! *Wood Dictionary* is certainly that and it is most comprehensive too. Increasingly, today, it is essential to be able to cope with technical literature written in a foreign tongue. Many of us surprise ourselves by remembering from school days or wartime journeying the more common words in French, German or Italian. Those, perhaps, who enjoy Spanish holidays have a smattering of that language. How annoying it is then when trying to translate for oneself some trade literature to find that the words which one cannot inderstand are the key words—and words moreover which are not included in one's pocket dictionary.

This book is admirably laid out. Three thousand seven hundred and twenty-eight technical words, no less, are listed in English/American (only one language to this Sworn Expert!) and translated across the page into French, Spanish, Italian, Swedish, Dutch and German. A thumb index to all the words used, separated into each language alphabetically, makes translation in either direction as simple as possible.

To complete the usefulness of this reference book the centre section has more than one hundred illustrations from the beetles—the woodwork attacking variety—to many examples of timber constructional methods and, though the hyperbolic paraboloid is not shown, the elliptic paraboloid and the conoid panel are.

This is a book which like its fellow *Dictionary of Agriculture* may only be used regularly by those who work in research establishments but which, on the odd occasion it is needed by those who work at a less specialized level, will be particularly valuable.

J.D.F.

The Economics of Agricultural Policy. GRAHAM HALLETT. Basil Blackwell, 1968. 50*s*.

On balance this book helps, at least partially, to fill the need for a text-book on agricultural economics dealing with the subject in a quantitative manner and using British and Continental examples. The layout adopted is sensible, with a first section on basic supply and demand theory and a second section on its practical application.

The final one deals with some agricultural policy problems: included here are chapters on the E.E.C.'s agricultural policy and its implications for British membership; farm structural policies; marketing boards and international commodity agreements.

The great strength of Dr. Hallett's exposition is in his discussion of the application of theory to practice. This is 'applied' economics where the necessary data to test theoretical concepts cannot always be found and one has to proceed by best-estimates and intuition for the 'areas of little knowledge'. The three chapters concerned deal with the demand and supply schedules, and distributive and processing margins.

The major drawback of this volume is that, owing to its wide coverage, the treatment tends to be superficial in places. For example, in the discussion of price discrimination we are launched straight into marginal revenue and costs without any discussion of the marginal concept. There again, in the policy sections which really could have been expanded, the Community's C.A.P. is discussed without the pointing out of the cardinal (and often missed) point that once Britain had joined, *all* future community decisions would be different as the Council of Ministers would have a differently-weighted selection of interests to reconcile.

To sum up, this book makes an extremely useful text-book for students of economics moving into agriculture, or *vice versa*, but although it would do many farmers good to read it, I do not feel that the style (which tends to read like college lecture notes) will encourage them. This is a pity as Dr. Hallett explains very well the conditions under which farmers have to operate. Throughout there are good references and bibliographies.

S.A.H.

Reproduction and Environment. R. L. HOLMES. Oliver and Boyd, 1968. 7*s.* 6*d.* (Paperback).

This book is an excellent example of the wide range of paperbacks now available which provide concise information on scientific subjects formerly found only in much more expensive and specialized literature.

The author, who is a Professor of Anatomy at the University of Leeds, has designed the book in the form of three chapters or essays. The first covers the effect of light, climate, temperature, food supplies and other stimuli on animal reproduction, and gives examples such as the association of bird song with the breeding season or the effect of climate on the timing of the lamb crop.

The agriculturist will note one or two minor inaccuracies—one refers to season of activity between various breeds of sheep—but these do not detract from the interest in the subject as a whole.

The long chapter on the anatomy and physiology of the nervous and endocrine systems illustrates the author's ability to write lucidly for the layman on a most interesting but complicated theme.

The final chapter postulates some of the practical implications of research into environmental effects. The use of light and temperature control in egg production is well known, but the suggestion that sheep might be transferred from the northern to the southern hemisphere annually to produce two lamb crops might not meet with unqualified support from the agricultural economist.

Professor Holmes concludes by giving a timely warning that it is not likely that progress will be without problems. We should remember not how much but how little we know about the basic mechanics underlying reproductive physiology, and the attendant dangers, if the natural pattern of reproductive life is too distorted.

G.H.B.

books received

Report of the Breeding and Production Organisation. No. 18. 1967–68. Milk Marketing Board. 10*s.* 6*d.* Copies available from Milk Marketing Board, Thames Ditton, Surrey.

Game on the Farm. Eley Game Advisory Station. 5*s.* Copies available (post paid) direct from the Station.

The Game Research Association Eighth Annual Report, 1968. Copies available from Eley Game Advisory Station, Fordingbridge, Hants. or the Game Research Association, 53 Northbrook Street, Newbury, Berkshire.

Farm Labour Studies No. 10. Payment Systems for Dairy Labour in South-West Scotland. Research Bulletin No. 41, 1968, R. TURNER and R. D. MURRAY, West of Scotland Agricultural College, 178 Bothwell Street, Glasgow, C.2.

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Ministry of Agriculture, Fisheries and Food

SELECTED PUBLICATIONS

Dairy Floors

Prepared by a sub-committee of the Milk and Milk Products Technical Advisory Committee, this report will be of interest to everyone concerned with the dairy industry. Architects, builders, plant designers, management and dairy technicians will find it a useful guide to all aspects of dairy floors. The main subjects covered are design; materials available; special considerations for various parts of the dairy; maintenance and repair. It contains a good bibliography. Illustrated.
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Farm Buildings Pocket-Book

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